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ORGANIC COMPOUNDS OF THE ACTINIDES AND LANTHANIDES

A COMPILATION OF DATA IN THE LITERATURE

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A Compilation of Data in the Literature

by

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ABSTRACT

A table of properties was compiled for some organic compounds of the actinide and lanthanide elements. The tabulated properties include appearance, melting points, boiling points, solubility data, stability, and molecular complexity. The majority of the compounds are β-diketone complexes, alkoxides, cyclopentadienides, or derivatives of these classes.

CONTENTS

ORGANIC COMPOUNDS OF THE ACTINIDES AND LANTHANIDES
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INTRODUCTION

Organic complexes of uranium, thorium, lanthanum, cerium, and other rare earth elements have been known since the end of the nineteenth century; however, only in recent years has the potential usefulness of such compounds been recognized, resulting in renewed interest in the subject. For example, volatile organic actinides and lanthanides might be used in isotope separation, in group separation of the actinides from the lanthanides, in the separation of elements in these groups from each other, in analytical procedures, and in the study of the coordination chemistry of these elements. In efforts to find suitable compounds of high volatility and stability, investigators have synthesized and characterized a wide variety of organic complexes of uranium, thorium, and the rare earths. The most extensively studied classes of compounds have been the β-diketone complexes, the alkoxides, the cyclopentadienides, and derivatives of these types.

This report is a compilation of properties such as appearance, melting points, boiling points, solubility in various solvents, stability, and molecular complexity (ratio of the experimentally determined molecular weight in a given solvent to the theoretical value) for a large number of organic actinides and lanthanides. The data were obtained from references which appeared in Chemical Abstracts, Chemical Titles, and Nuclear Science Abstracts through May 1964. Although the report was originally intended to cover mainly volatile compounds, it has been extended for the purpose of completeness and comparison to include many compounds that are neither volatile nor stable. Furthermore, the amount of data for many of the compounds is very limited.

The compounds have been arranged in the order indicated in the contents; however, the β-diketone complexes of uranium(IV) and (VI) and the alkoxides of uranium(V), thorium, and cerium are so numerous that a brief explanation of their order of arrangement may be helpful in locating a given compound within one of these classes. The β-diketone complexes have been divided into four groups according to the following types of β-diketones: (1) CH_3COCH_2COR, (2) $RCOCH_2COR$, (3) $C_6H_5COCH_2COR$, and (4) CF_3COCH_2COR (R may be any group from H or CH_3 - up to very complex radicals). The alkoxides are arranged in order of increasing number of carbon atoms in the alkoxy groups. Within a given alkoxy group the primary

alkoxides are followed by the secondary alkoxides, and the latter, by the tertiary alkoxides. Derivatives are arranged according to the parent compound. For example, $(n\text{-}C_3H_7O)_4UCl$ follows $(n\text{-}C_3H_7O)_5U$ and $NaU(OC_2H_5)_6$ follows $U(OC_2H_5)_5$.

For convenience, references are given along with each compound and are keyed to the data when a compound has two or more references. The references are also listed in the bibliography. The following abbreviations are used for common organic radicals and for some of the journal references:

ABBREVIATIONS

THF = tetrahydrofuran
Me = methyl
Et = ethyl
Pr = propyl
Bu = butyl
Am = amyl
Hex = hexyl
Ph = phenyl
CA = Chemical Abstracts
ACS = Acta Chem. Scand.
Ann = Liebigs Annalen der Chemie
JACS = J. Am. Chem. Soc.
JINC = J. Inorg. Nucl. Chem.
JCS = J. Chem. Soc.
JCP = J. Chem. Phys.

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
Lanthanum								
$(C_5H_5)_3La$	colorless solid	395(slight dec.)	sublimes 260/ 0.0001	moderately s. pyridine, THF, glycoldimethyl ether, dioxane; i. petroleum ether, benzene, cyclohexane; sparingly s. liquid ammonia	dec. by water, air, dil. acids, CS_2, CCl_4, $CHCl_3$		[5]JACS 78 42 [74]JACS 76 6210	
$(MeCOCHCOMe)_3La$		185[3] 151[40] 142-143[70] softens 85, melts 149-151[50]		s. alcohol[3] benzene[50]		probably dimeric[3]	[3]Ann. 331 334 [40]Ber. 53B 1577 [70]JACS 70 3142 [50]Kennelley, Thesis, MSU (1956)	solubility data in benzene[50] X-ray data[50]
$(MeCOCHCOMe)_3La\cdot 2H_2O$		softens 85-91, gas evoly. 147-151,[3] melts 188-190[50]					[3]Ann. 331 334 [50]Kennelley, Thesis, MSU (1956)	IR spectra[50] X-ray data[50]
$(MeCOCHCOMe)_3La\cdot NH_3$		147.5			loses NH_3 in boiling alcohol		[40]Ber. 53B 1577	
$(MeCOCHCOMe)_3La\cdot C_5H_5N$		142					[40]Ber. 53B 1577	
$(MeCOCHCOMe)_3La\cdot$ 		192					[40]Ber. 53B 1577	
$(MeCOCHCOPh)_3La\cdot 2H_2O$	straw-colored solid	108-109		s. benzene, $CHCl_3$, nearly i. water			[61]Gazz. chim. ital. 79 731	
$(PhCOCHCOPh)_3La$	light yellow needles	141-143		s. alcohol			[40]Ber. 53B 1577	
$(PhCOCHCOPh)_3La\cdot H_2O$	straw-yellow solid	142-145		s. benzene, $CHCl_3$; nearly i. water			[61]Gazz. chim. ital. 79 731	
$(PhCOCHCOPh)_3La\cdot NH_3$	yellow needles	99			loses NH_3 upon standing in air		[40]Ber. 53B 1577	
Cerium(III)								
$(C_5H_5)_3Ce$	orange-yellow crystalline solid	435 (slight dec.)	sublimes 230/ 0.0001	moderately s. pyridine, THF, glycoldimethyl ether, dioxane; sparingly s. liquid ammonia; i. petroleum ether, benzene, cyclohexane	dec. by water, air, dil. acids, CS_2, CCl_4, $CHCl_3$		[5]JACS 78 42, [74]JACS 76 6210	magnetic data, 77-295°K[5]
$(MeCOCHCOMe)_3Ce$	fawn-colored solid[3]	131-132[3] 146-147[70]		s. alcohol; slightly s. ether[3]		values between monomer and dimer in CCl_4[3]	[3]Ann. 331 334 [70]JACS 70 3142	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(MeCOCHCOMe)_3$ $Ce\cdot 3H_2O$	yellow crystals	145					[a]Ann. 331 334	
Cerium(IV)								
$(MeO)_4Ce$	yellow solid	dec. without melting above 200	nonvolatile	i. boiling methanol, benzene, pyridine, toluene	dec. by water		[a]JCS 2260 (1956)	
$(EtO)_4Ce$	yellow solid	dec. without melting above 200	nonvolatile	i. benzene, toluene	dec. by water		[a]JCS 2260 (1956)	
$(n\text{-}PrO)_4Ce$	yellow solid	dec. without melting above 200	nonvolatile	s. benzene, toluene	dec. by water	4.30 in benzene 3.44 in toluene (ebulliometric)	[a]JCS 2260 (1956)	
$(i\text{-}PrO)_4Ce$	yellow solid		sublimes, 160-170/0.05	s. organic solvents		3.13 in benzene 2.78 in toluene (ebulliometric)	[a]JCS 3469 (1956)	
$(i\text{-}PrO)_4$ $Ce\cdot i\text{-}PrOH$	crystalline solid			s. isopropyl alcohol	dissociates 100°/0.05 mm		[a]JCS 2260 (1956) [a]JCS 3469 (1956)	
$(i\text{-}PrO)_4$ $Ce\cdot C_5H_5N$	yellow crystals			s. pyridine			[a]JCS 2260 (1956)	
$(n\text{-}BuO)_4Ce$	yellow solid	dec. without melting above 200	nonvolatile	s. benzene, toluene	dec. by water	4.20 in benzene 3.48 in toluene (ebulliometric)	[a]JCS 2260 (1956)	
$(i\text{-}BuO)_4Ce$	yellow solid	dec. without melting above 200	nonvolatile	s. benzene, toluene	dec. by water	4.20 in benzene 3.40 in toluene (ebulliometric)	[a]JCS 2260 (1956)	
$(sec\text{-}BuO)_4Ce$			nonvolatile	s. benzene, toluene		2.99 in benzene 2.80 in toluene (ebulliometric)	[a]JCS 3469 (1956)	
$(t\text{-}BuO)_4Ce$	yellow needles		sublimes, 140-150/0.1	s. benzene, toluene	dec. by water	2.5 in benzene 2.2 in toluene (ebulliometric)	[10]JCS 2600 (1957)	
$(t\text{-}BuO)_3CeCl\cdot$ C_5H_5N	lemon-yellow crystals						[10]JCS 2600 (1957)	
$(CCl_3Me_2CO)_4$ $Ce\cdot C_5H_5N$			dec. 115-120/0.1				[12]JCS 4651 (1958)	
$(n\text{-}AmO)_4Ce$	yellow solid	dec. without melting above 200	nonvolatile	s.benzene, toluene	dec. by water	4.20 in benzene 3.40 in toluene (ebulliometric)	[a]JCS 2260 (1956)	
$(neo\text{-}AmO)_4Ce$ $([Me_3CCH_2O]_4Ce)$	yellow solid		sublimes, 260/0.05	s. benzene, toluene	dec. by water	2.53 in benzene 2.45 in toluene (ebulliometric)	[a]JCS 2260 (1956)	
$(Me\ n\text{-}PrCHO)_4Ce$			nonvolatile	s. benzene, toluene		3.11 in benzene 2.79 in toluene (ebulliometric)	[a]JCS 3469 (1956)	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(Me\ i\text{-}PrCHO)_4Ce$			nonvolatile	s. benzene, toluene		3.00 in benzene 2.82 in toluene (ebulliometric)	[9]JCS 3469 (1956)	
$(Et_2CHO)_4Ce$			nonvolatile	s. benzene, toluene		2.90 in benzene 2.80 in toluene (ebulliometric)	[9]JCS 3469 (1956)	
$(t\text{-}AmO)_4Ce$	yellow solid		sublimes, 240/0.1	s. benzene, toluene	dec. by water	2.4 in benzene 2.2 in toluene (ebulliometric)	[10]JCS 2600 (1957)	
$(t\text{-}AmO)_3$ $CeCl\cdot C_5H_5N$	bright yellow crystals						[10]JCS 2600 (1957)	
$(Me_2n\text{-}PrCO)_4Ce$	bright yellow liquid		146/0.05	s. benzene, toluene	dec. by water	1.4 in benzene 1.1 in toluene (ebulliometric)	[10]JCS 2600 (1957)	
$(Me_2i\text{-}PrCO)_4Ce$	bright yellow liquid		132/0.05	s. benzene, toluene	dec. by water	1.1 in benzene 1.0 in toluene (ebulliometric)	[10]JCS 2600 (1957)	
$(MeEt_2CO)_4Ce$	bright yellow liquid		140/0.06	s. benzene, toluene	dec. by water	1.4 in benzene 1.1 in toluene (ebulliometric)	[10]JCS 2600 (1957)	
$(MeEtn\text{-}PrCO)_4Ce$	bright yellow liquid		150/0.05	s. benzene, toluene	dec. by water	1.0 in benzene (ebulliometric)	[10]JCS 2600 (1957)	
$(Et_3CO)_4Ce$	bright yellow liquid		154/0.05	s. benzene, toluene	dec. by water	1.1 in benzene 1.0 in toluene (ebulliometric)	[10]JCS 2600 (1957)	
$(MeCOCHCOMe)_4Ce$	black metallic crystals[41]	171-172[41]		s. organic solvents[41]			[41]Compt. rend. 157 50 [30]Acta Cryst. 12 817	crystal data[30]
$(MeCOCHCOPh)_4Ce$	red-brown crystals	187-188		slightly s. benzene, $CHCl_3$; i. alcohol, water			[61]Gazz. chim. ital. 79 731	
$(PhCOCHCOPh)_4Ce$	red-brown solid	192-193[61]		slightly s. benzene, $CHCl_3$; i. alcohol, water[61]			[61]Gazz. chim. ital. 79 731 [75]Acta Cryst. 10 605	crystal data[75]
Praseodymium								
$(C_5H_5)_3Pr$	pale green crystalline solid	415 (slight dec.)	sublimes, 220/0.0001	moderately s. pyridine, THF, glycoldimethyl ether, dioxane; sparingly s. liquid ammonia; i. petroleum ether, benzene, cyclohexane	dec. by water, air, dil. acids, CS_2, CCl_4, $CHCl_3$		[5]JACS 78 42 [74]JACS 76 6210	visible absorption spectra in THF; magnetic data, 77-295°K[5]

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(MeCOCHCOMe)_3Pr$	light green solid[3]	146[3] 143-144[70]		s. CS_2, ether, $CHCl_3$, benzene, alcohol[3]		~1.9 in CS_2[3] (ebulliometric)	[3]Ann 331 334 [70]JACS 70 3141	
$(MeCOCHCOPh)_3$ $Pr\cdot 2H_2O$	green-yellow solid	106-108		s. benzene, $CHCl_3$; nearly i. water			[61]Gazz. chim. ital. 79 731	
$(PhCOCHCOPh)_3$ $Pr\cdot H_2O$	yellow solid	149-151		s. benzene, $CHCl_3$; nearly i. water			[61]Gazz. chim. ital. 79 731	
Neodymium								
$(C_5H_5)_3Nd$	reddish-blue crystalline solid	380	sublimes, 220/0.0001	moderately s. pyridine, THF, glycoldimethyl ether, dioxane; sparingly s. liquid ammonia; i. petroleum ether, benzene, cyclohexane	dec. by water, air, dil. acids, CS_2, CCl_4, $CHCl_3$	1.0 in THF (isothermal distillation method)	[5]JACS 78 42 [74]JACS 76 6210	magnetic data, 77-295°K[5]
$(MeCOCHCOMe)_3Nd$	violet crystals[3]	144-146[3] 144-145[70] 144-146[80]		s. CS_2, ether, $CHCl_3$, benzene, alcohol[3] CCl_4[80]		1.97 in ethyl sulfide[3] (ebulliometric)	[3]Ann. 331 334 [70]JACS 70 3142 [80]Kennelley, Thesis, MSU (1956)	solubility data in benzene, CCl_4 acetylacetone, $CHCl_3$[80] X-ray data[80]
$(MeCOCHCOMe)_3$ $Nd\cdot 3H_2O$		144-146					[80]Kennelley, Thesis, MSU (1956)	visible and uv spectra in $CHCl_3$; IR spectra; X-ray data
$(MeCOCHCOPh)_3$ $Nd\cdot 2H_2O$)	pale lilac solid	106-108		s. benzene, $CHCl_3$; nearly i. water			[61]Gazz. chim. ital. 79 731	
$(PhCOCHCOPh)_3$ $Nd\cdot H_2O$	lilac-green dichroism	147-150		s. benzene, $CHCl_3$; nearly i. water			[61]Gazz. chim. ital. 79 731	
Samarium								
$(C_5H_5)_3Sm$	orange crystalline solid	365	sublimes, 220/0.0001	moderately s. pyridine, THF, glycoldimethyl ether, dioxane; sparingly s. liquid ammonia; i. petroleum ether, benzene, cyclohexane	dec. by water air, dil. acids CS_2, CCl_4, $CHCl_3$		[5]JACS 78 42 [74]JACS 76 6210	magnetic data, 77-295°K[5]
$(C_5H_5)_2SmCl$	yellow solid[54,81,88]	none, dec. above 200[54,81,88]	sublimes, 150-250/ 0.00001[54,81]	s. THF; i. hydrocarbons, CS_2[54,81]	dec. in air, protolytic solvents[54,81] CCl_4[81]		[54]JACS 85 672 [83]TID 17309 [81]TID 15018 [88]TID 19613	magnetic data 195, 300°K[54,83,88] IR absorption peaks[54,81]
$(C_5H_5)SmCl_2$ $(THF)_3$	tan needles[82,88]	none, changes color at 55; progressively darkens to 240[82,88]	nonvolatile at reduced pressures[82]	s. THF, acetone somewhat s. benzene, diethyl ether; i. CCl_4, CS_2, alkanes[82]	thermally unstable; dec. in air and water[82]		[82]TID 16224 [88]TID 19613	IR absorption peaks[82]

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(MeCOCHCOMe)_3Sm$	bright yellow solid[3]	146-147[3] 144-145[70]		s. alcohol, CCl_4, CS_2[3]; slightly s. water[3]		~1.85 in CS_2[3] (ebulliometric)	[3]Ann. 331 334 [70]JACS 70 3142	
$(MeCOCHCOPh)_3$ $Sm\cdot 2H_2O$	straw-colored solid	103-105		s.benzene, $CHCl_3$; nearly i. water			[81]Gazz. chim. ital. 79 731	
$(PhCOCHCOPh)_3$ $Sm\cdot H_2O$	golden-yellow solid	148-149		s. benzene, $CHCl_3$; nearly i. water			[81]Gazz. chim. ital. 79 731	
Europium								
$(C_5H_5)_3Eu(THF)$	brown shiny solid			s. THF			[83]TID 17309	
$(C_5H_5)EuCl_2$ $(THF)_3$	purple solid[82,86]	none-changes color at 55; darkens progressively to 240[82,86]	nonvolatile at reduced pressures[82]	s. THF, acetone; somewhat s. benzene, diethyl ether; i. CCl_4, CS_2, alkanes[82]	thermally unstable; dec. in air and water[82]		[82]TID 16224 [83]TID 17309 [86]TID 19613	magnetic data, 194, 300°K[83,86] IR absorption peaks[82]
$(MeCOCHCOMe)_3Eu$		144-145[70]; turned brown above 150 without melting[50]		s. benzene, CCl_4, $CHCl_3$, acetylacetone[28]			[70]JACS 70 3142 [50]Kennelley, Thesis, MSU (1956) [28]JACS 63 1079	solubility data in benzene, CCl_4, acetylacetone, $CHCl_3$[50]; X-ray data[50]; visible spectra in benzene, CCl_4[28]
$(MeCOCHCOMe)_3Eu\cdot 3H_2O$		145-147(dec)					[50]Kennelley, Thesis, MSU (1956)	IR spectra; X-ray data
Gadolinium								
$(C_5H_5)_3Gd$	yellow crystalline solid	350	sublimes, 220/0.0001	moderately s. pyridine, THF, glycoldimethyl ether, dioxane; sparingly s. liquid ammonia, i. petroleum ether, benzene, cyclohexane	dec. by water, air, dil. acids, CS_2, CCl_4, $CHCl_3$		[5]JACS 78 42 [74]JACS 76 6210	magnetic data, 77 - 295°K[5]
$(C_5H_5)_2GdCl$	colorless crystals	none, dec. above 140°	sublimes, 150-250/ 0.00001[54]	s. THF; i. hydrocarbons, CS_2[80,81,86]	dec. in air, protolytic solvents CCl_4[80,81]	1.16 in THF (ebullio-metric)[54,80,81]	[54]JACS 85 672 [80]TID 14260 [81]TID 15018 [86]TID 19613 [83]TID 17309	magnetic data, 195, 301°K[54,86,83] IR absorption peaks[54,80]
$(C_5H_5)GdCl_2$ $(THF)_3$	purple solid[82,86]	cloudy liquid at 86°[82,86]	nonvolatile at reduced pressures[82]	s. THF, acetone; somewhat s. benzene, diethyl ether; i. CCl_4, CS_2, alkanes[82]	thermally unstable; dec. in air, water[82]	~1.36 in THF (ebullio-metric)[82]	[82]TID 16224 [86]TID 19613	IR absorption peaks[82]

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(MeC_5H_4)_2GdCl$	colorless solid	188-197	sublimes, 135-230/0.00001	s. THF, benzene, CS_2; slightly s. petroleum ether	dec. in air, protolytic solvents CCl_4	1.12 in THF; 2.13 in benzene (ebulliometric)	(54)JACS 85 672 (81)TID 15018	IR absorption peaks(81)
$(MeC_5H_4)_2(MeCOO)Gd$	white crystals	207-209	sublimes, 160-250/ 0.00001(54)	s. THF, benzene, acetone, CS_2, petroleum ether(54,82)	fairly stable in air; dec. in water(54,82)		(54)JACS 85 672 (82)TID 16224 (86)TID 19613	
$(MeCOCHCOMe)_3Gd \cdot H_2O$		142					(40)Ber. 53B 1577	
$(MeCOCHCOMe)_3Gd \cdot C_5H_5N$		139.5					(40)Ber. 53B 1577	
$(MeCOCHCOPh)_3Gd \cdot 2H_2O$	colorless solid	100-101		s. benzene, $CHCl_3$; nearly i. water			(81)Gazz. chim. ital 79 731	
$(PhCOCHCOPh)_3Gd \cdot H_2O$	green-yellow by transmitted light; rose-yellow by reflection	214-216		s. benzene, $CHCl_3$; nearly i. water			(81)Gazz. chim. ital. 79 731	
Dysprosium								
$(C_5H_5)_3Dy$	yellow crystalline solid	302	sublimes, 220/0.0001	moderately s. pyridine, THF, glycoldimethyl ether, dioxane, sparingly s. liquid ammonia; i. petroleum ether, benzene, cyclohexane	dec. by water, air, dil. acids, CS_2, CCl_4, $CHCl_3$		(5)JACS 78 42	magnetic data, 77-295°K
$(C_5H_5)_2DyCl$	yellow solid(54,81,86)	343-346 (dec)(54, 81, 86)	sublimes, 150-250/ 0.00001(54,81)	s. THF, i. hydrocarbons, CS_2(54,81)	dec. in air, protolytic solvents(54,81) CCl_4(81)		(54)JACS 85 672 (83)TID 17309 (81)TID 15018 (86)TID 19613	magnetic data 195, 300°K(54,83, 86) IR absorption peaks(54,81)
$(C_5H_5)DyCl_2(THF)_3$	colorless needles	85-90(dec)		s. THF; slightly s. benzene; i. petroleum ether(83)	thermally unstable(83)		(83)TID 17309 (86)TID 19613	magnetic data 194, 300°K
$(C_5H_5)_2(MeO)Dy$	yellow solid	dec. >235	sublimes, 160-230/ 0.00001(54,82)	s. THF, benzene CS_2(54,82)	dec. in air, water(54,82)		(54)JACS 85 672 (82)TID 16224 (86)TID 19613	IR absorption spectra in CS_2(54)
Holmium								
$(C_5H_5)_2HoCl$	yellow-orange crystals(54,81,86)	340-343 (dec)(54, 81, 86)	sublimes, 210/ 0.00001(54,81)	s. THF; i. hydrocarbons, CS_2(54,81)	dec. in air, protolytic solvents(54,81) CCl_4(81)		(54)JACS 85 672 (83)TID 17309 (81)TID 15018 (86)TID 19613	magnetic data 195 300°K(54,83,86) IR absorption peaks(54,81)

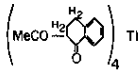
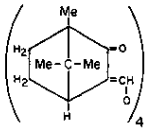
Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(C_5H_5)HoCl_2(THF)_3$	yellow-orange solid	84-92	nonvolatile at reduced pressures[82]	s. THF, acetone; somewhat s. benzene, diethyl ether; i. CCl_4, CS_2 alkanes[82]	thermally unstable; dec. in air, water[82]	1.12 in THF (ebulliometric)[82]	[82]TID 16224 [86]TID 19613	IR absorption peaks[82]
Erbium								
$(C_5H_5)_3Er$	pink crystalline solid	285	sublimes, 200/0.0001	moderately s. pyridine, THF, glycoldimethyl ether, dioxane; sparingly s. liquid ammonia; i. petroleum ether, benzene, cyclohexane	dec. by water, air, dil. acids, CS_2, CCl_4, $CHCl_3$		[5]JACS 78 42	magnetic data, 77-295°K; visible absorption spectra in THF
$(C_5H_5)_2ErCl$	pink solid	none, dec. above 200°	sublimes, 150-250/0.00001[54,80]	s. THF; i. hydrocarbons, CS_2[54,80,81]	dec. in air, protolytic solvents[54,83,80] CCl_4[80,81]	1.02 in THF (ebulliometric)[54]	[54]JACS 85 672 [83]TID 17309 [80]TID 14260 [81]TID 15018 [86]TID 19613	magnetic data 195, 300°K[54,83,86] IR absorption peaks[54,80]
$(C_5H_5)ErCl_2(THF)_3$	pink solid[82,86]	91-94[82,86]	nonvolatile at reduced pressures[82]	s. THF, acetone; somewhat s. benzene, diethyl ether; i. CS_2, CCl_4, alkanes[82]	thermally unstable; dec. in air, water[82]	~1.35 in THF (ebulliometric)[82]	[82]TID 16224 [83]TID 17309 [86]TID 19613	magnetic data 194, 300°K[83,86] IR absorption peaks[82]
$(C_5H_5)_2ErI$	pink crystals	270(dec)	sublimes, 150-250/0.00001	s. THF, acetone; slightly s. benzene; i. petroleum ether			[54]JACS 85 672 [81]TID 15018	
$(C_5H_5)_2ErNH_2$	pink solid	330-334	sublimes, 150-245/0.00001[54,82]	s. THF, acetone; slightly s. benzene; i. petroleum ether[54,82]	dec. in air, water[54,82]		[54]JACS 85 672 [82]TID 16224 [86]TID 19613	IR absorption peaks[82]
$(C_5H_5)_2(MeO)Er$	pink solid	236-240	sublimes, 160-200/0.00001	s. THF, CS_2, benzene	dec. in air, water		[54]JACS 85 672 [82]TID 16224	IR absorption peaks in CS_2
$(C_5H_5)_2(HCOO)Er$	pink solid	none, dec. above 270	sublimes, 165-250/0.00001[54,82]	s. THF, i. benzene, CCl_4, CS_2[54,82]	fairly stable in air; dec. in water[54,82]		[54]JACS 85 672 [82]TID 16224 [86]TID 19613	
$(C_5H_5)_2(MeCOO)Er$	pink solid	331-335(dec.)	sublimes, 160-250/0.00001[54,82]	slightly s. THF, benzene, CS_2[54,82]	stable in air; dec. in water[54,82]		[54]JACS 85 672 [82]TID 16224 [86]TID 19613	IR absorption peaks[54,82]
$(MeC_5H_4)_2ErCl$	pink solid	119-122	sublimes, 135-230/0.00001[81]	s. THF, benzene, CS_2; slightly s. petroleum ether	dec. in air, protolytic solvents, CCl_4	2.10 in benzene (ebulliometric)	[54]JACS 85 672 [81]TID 15018	

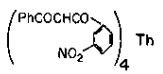
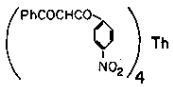
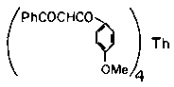
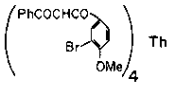
Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(MeC_5H_4)_2(MeCOO)Er$	pink solid	199-201	sublimes, 160-250/ 0.00001[54,83]	s. THF, benzene, ethyl ether, CCl_4, CS_2; i. petroleum ether[83]	fairly stable in air; dec. in water[54,83]	2.11 in benzene (ebullio-metric[54,83])	[54]JACS 85 672 [83]TID 17309 [86]TID 19613	
Ytterbium								
$(C_5H_5)_3Yb$	dark green crystalline solid	273(slight dec.)	sublimes, 150/0.0001	moderately s. pyridine, THF, glycoldimethyl ether, dioxane; sparingly s. liquid ammonia, i. petroleum ether, benzene, cyclohexane	dec. by water, air, dil. acids, CS_2, CCl_4, $CHCl_3$		[5]JACS 78 42	magnetic data, 77-295°K
$(C_5H_5)_2YbCl$	orange-red crystals	none, dec. above 240°	sublimes, 220/ 0.00001[54,81]	s. THF, i. hydrocarbons, CS_2[54,80,81]	dec. in air, protolytic solvents[54, 80, 81] CCl_4[80,81]	1.04 in THF (ebullio-metric)[54,81]	[54]JACS 85 672 [83]TID 17309 [80]TID 14260 [81]TID 15018 [86]TID 19613	magnetic data 195, 301°K[54,83,86] IR absorption peaks[54,80]
$(C_5H_5)YbCl_2(THF)_3$	orange crystals[82,86]	78-81[82,86]	nonvolatile at reduced pressure[82]	s. THF, benzene ether, acetone; i. petroleum ether	thermally unstable; dec. in air, water[82]		[82]TID 16224 [83]TID 17309 [86]TID 19613	magnetic data 194, 300°K[83,86] IR absorption peaks[82]
$(C_5H_5)_2(MeO)Yb$	orange solid	290-305	sublimes, 160-200/ 0.00001[54,82]	s. THF, CS_2 benzene[54,82]	dec. in air, water[54,82]		[54]JACS 85 672 [82]TID 16224 [86]TID 19613	IR absorption peaks in CS_2[54,82]
$(C_5H_5)_2(PhO)Yb$	red solid	382-386	sublimes, 275/ 0.0001[54,82]	slightly s. THF; i. benzene, ether, pyridine, CS_2; acetone[54,82]	very stable in air[54,82]		[54]JACS 85 672 [82]TID 16224 [86]TID 19613	IR absorption peaks[82]
$(C_5H_5)_2(HCOO)Yb$	orange powder	none up to 400°, changes color >250°	nonvolatile at reduced pressures[82]	s. THF; slightly s. benzene; i. petroleum ether	fairly stable in air; dec. in water[54,82] thermally unstable[82]		[54]JACS 85 672 [82]TID 16224	IR absorption peaks
$(C_5H_5)_2(MeCOO)Yb$	orange solid	325-329(dec.)	sublimes, 160-250/ 0.00001[54,82]	slightly s. THF, benzene, CS_2[54,82]	stable in air; dec. in water[54,82]		[54]JACS 85 672 [82]TID 16224 [86]TID 19613	IR absorption peaks[54,82]
$(C_5H_5)_2(PhCOO)Yb$	orange solid	350-375(dec.)	sublimes, 270/0.001[54,82]	very slightly s. THF, benzene[54,82]	fairly stable in air; dec. in water[54,82]		[54]JACS 85 672 [82]TID 16224 [86]TID 19613	IR absorption peaks[82]
$(MeC_5H_4)_2YbCl$	red solid	115-120	sublimes, 135-230/ 0.00001	s. THF, benzene, CS_2; slightly s. petroleum ether	dec. in air, protolytic solvents[54, 81] CCl_4[81]	1.07 in THF 2.06 in benzene (ebullio-metric)[54,81]	[54]JACS 85 672 [81]TID 15018	

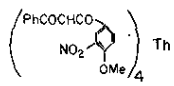
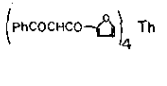
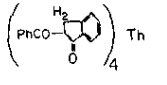
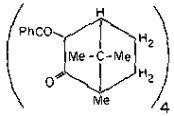
Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
Lutetium								
$(C_5H_5)_2LuCl$	pale greenish-white crystals[54]	318-320[54]	sublimes, 170-240/ 0.00001[54]	s. THF; i. hydrocarbons, CS_2[54]	dec. in air, protolytic solvents[54]		[54]JACS 85 672 [83]TID 17309 [88]TID 19613	magnetic data at 300°K[54,83,88] IR absorption peak[54]
$(C_5H_5)LuCl_2(THF)_3$	white crystalline solid	76-78	s. THF, benzene diethyl ether; i. petroleum ether[83]	thermally unstable[83]			[83]TID 17309 [88]TID 19613	
Thorium								
$(MeO)_4Th$	white powder		nonvolatile up to 300/0.05, dec. above 300/0.05	i. benzene	dec. by water		[6]JCS 1091 (1954)	
$(EtO)_4Th$	white solid		nonvolatile up to 300/0.05	sparingly s. benzene, ethyl alcohol	dec. by water; dec. above 300/0.05		[6]JCS 1091 (1954)	
$(i\text{-}PrO)_4Th$	white crystalline solid		sublimes, 200-210/ 0.05-0.1	s. benzene, isopropyl alcohol	dec. by water	3.8 in benzene; 1.8 in isopropyl alcohol (ebulliometric)	[6]JCS 1091 (1954)	
$(n\text{-}BuO)_4Th$	solid		nonvolatile in vacuo	s. benzene		6.44 in benzene (ebulliometric)	[6]JCS 2260 (1956)	
$(sec\text{-}BuO)_4Th$			nonvolatile	s. benzene		4.2 in benzene (ebulliometric)	[6]JCS 3469 (1956)	
$(t\text{-}BuO)_4Th$			sublimes, 160/0.1	s. benzene	dec. by water	3.4 in benzene (ebulliometric)	[7]JCS 3488 (1954)	
$(Me_2(CCl_3)CO)_4Th\cdot 2C_5H_5N$			dec. 115-120/0.1				[12]JCS 4651 (1958)	
$(n\text{-}AmO)_4Th$	solid		nonvolatile in vacuo	s. benzene		6.20 in benzene (ebulliometric)	[6]JCS 2260 (1956)	
$(neo\text{-}AmO)_4Th$ ($[Me_3CCH_2O]_4Th$)	solid		nonvolatile in vacuo	s. benzene		4.01 in benzene (ebulliometric)	[6]JCS 2260 (1956)	
$(Et_2CHO)_4Th$			nonvolatile	s. benzene		4.1 in benzene (ebulliometric)	[6]JCS 3469 (1956)	
$(t\text{-}AmO)_4Th$			208/0.3[7] 198/0.1[10]	s. benzene	dec. by water	2.8 in benzene (ebulliometric)	[7]JCS 3488 (1954) [10]JCS 2600 (1957)	
$(Me_2n\text{-}PrCO)_4Th$			dec. above 120/0.1	s. benzene	dec. by water	2.6 in benzene (ebulliometric)	[7]JCS 3488 (1954)	
$(Me_2i\text{-}PrCO)_4Th$			dec. above 120/0.1	s. benzene	dec. by water	2.3 in benzene (ebulliometric)	[7]JCS 3488 (1954)	
$(MeEt_2CO)_4Th$			148/0.1	s. benzene	dec. by water	1.8 in benzene (ebulliometric)	[7]JCS 3488 (1954)	
$(MeEtn\text{-}PrCO)_4Th$			153/0.1	s. benzene	dec. by water	1.7 in benzene (ebulliometric)	[7]JCS 3488 (1954)	
$(MeEti\text{-}PrCO)_4Th$			139/0.05	s. benzene	dec. by water	1.0 in benzene (ebulliometric)	[7]JCS 3488 (1954)	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(Et_3CO)_4Th$			148/0.05[7] 154/0.1[10]	s. benzene	dec. by water	1.0 in benzene (ebulliometric)	[7]JCS 3488 (1954) [10]JCS 2600 (1957)	
$Th(BH_4)_4$	white crystalline solid	203(dec.)	v.p. = 0.05 mm at 130° v.p. = 0.2 mm at 150°	s. THF, diethyl ether; i. benzene	stable at 150°		[55]JACS 71 2488	
$(C_5H_5)_4Th$	colorless crystals[24]	dec. without melting ~170	sublimes, 170-190 in vacuo[24]; sublimes (dec.)[59]	s. CH_2Cl_2, $CHCl_3$, $CHBr_3$; i. pentane, benzene, diethyl ether, THF, dioxane, acetone, CCl_4[24]	fairly stable in air[24]; dec. by water, dilute acids and bases[24]; dec. in air[55]	1.05 in $CHBr_3$ (cryoscopic)[24]	[24]Z. Naturforsch. 17b, 276 [59]JINC 2 246	magnetic data 90, 295°K IR spectra NMR data[24]
$(C_5H_5)_3ThCl$	white solid[64]		sublimes, 180-200/ 0.0001[64]	s. THF, $CHCl_3$, CH_2Cl_2; i. petroleum ether[64]	dec. in air, water[64]	0.98 in CH_2Cl_2 (ebullio-metric)[64]	[64]TID 18749 [87]TID 20123	magnetic data[64] IR spectra[64] NMR data[87]
$(C_5H_5)_3(MeO)Th$	white solid		sublimes, 100/0.0001	very s. THF; moderately s. benzene, $CHCl_3$	dec. in air		[87]TID 20123	
$(C_5H_5)_3(n\text{-}BuO)Th$	white solid		sublimes, 100/0.0001	very s. THF; moderately s. benzene, $CHCl_3$	dec. in air		[87]TID 20123	
$(MeCOCHCOMe)_4Th$	colorless crystals[3,77,78]	171-172[72] 171[3] 171.5[77] 170.8-171[78] 168-170[56]	sublimes, 160/0.1[78]; 260-270/1 dec.[56]; v.p. at 100° = 3.2 ±0.3 x 10^{-4} mm[78]	s. benzene, $CHCl_3$[72,3], toluene[77], CS_2, $CHBr_3$[3]; slightly s. ether, ethylene dibromide[72]; i. water[72,3,77], petroleum ether[77]		1.0 in 0.022 molal ethylene dibromide[72], 1.2 in 0.019 molal ethylene dibromide[3] (cryoscopic); 1.10-1.15(0.078 - 0.238 molal benzene) (cryoscopic)[3]; 0.98-1.06 (0.059-0.158 molal CS_2) (ebulliometric)[3]; 0.90-0.73 (0.037 - 0.177 molal $CHCl_3$) (ebulliometric[3]); 1.21 - 0.89 in $CHBr_3$ (cryoscopic)[3]	[72]Bull soc. chim. (3)15 347 [3]Ann 331 334 [77]Inorg. Syn. II 123 (1946) [78]JACS 61 876 [56]JCS 105 189 [52]Spectrochim. Acta 17 248 [53]Disc. Faraday Soc. 9, 125 (1950) [21]JCS 4655 (1958) [57]AECD-2659 [38]JACS 80 5658 [51]Acta Chim. Acad. Sci. Hung. 13 49 [38]JCP 16 920 [55]J. Indian Chem. Soc. 34 189 [23]JCS 1254 (1938) [22]JCS 1269 (1938) [58]Can. J. Chem. 36 574 [71]LA 1439 [18]Gazz. chim. ital. 89 939 [30]Acta Cryst. 12 817 [31]Nature 182 465	IR spectra[55,52,53,21,19]; UV spectra[38,51]; NMR data[38]; diamagnetic susceptibility[38,55]; dielectric polarization[23,22,58]; refractive index[71] visible spectra[18]; crystal data[30,31]

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(MeCOCHCOMe)_4$ Th·$MeCOCH_2COMe$		150		s. molten biphenyl, 100°C			[2]ORNL-2864	
$(MeCOCHCOMe)_4Th \cdot PhNH_2$		115		slightly s. ether			[3]Ann. 331 334	
$(MeCOCHCOPh)_4Th$	pale yellow powder[25] white crystals[76,81]	212-213 (dec.)[25]; 216-217[76]; 215-216[81]		s. boiling benzene, dioxane, pyridine, anisole[76]; slightly s. benzene, toluene, aniline, pyridine[25] difficulty s. boiling $CHCl_3$, toluene, xylene[76], very difficulty s. boiling ethyl acetate[76] i. water, acetone[25] boiling petroleum ether, ether, methanol, ethanol, acetone, isoamyl alcohol, isohexanol, CS_2, CCl_4, methyl benzoate[76]	dec. in boiling THF[76]	1.02 in benzene (ebulliometric)[76]	[25]ACS 3 1133 [76]J. prakt. Chem. 1 257 [81]Gazz. chim. ital. 79 731	
$(MeCOCHCO-C_6H_3(OMe)-)_4Th$	bright yellow powder	208-210(dec.)		very s. boiling $CHCl_3$, benzene, toluene, xylene, anisole, pyridine; very difficulty s. boiling acetone, isoamyl alcohol isohexanol, ethyl acetate; i. boiling petroleum ether, ether, methanol, ethanol, CS_2, CCl_4	dec. in boiling THF, dioxane, methyl benzoate		[76]J. prakt. Chem. 1 257	
$(MeCO-C_6H_6O-)_4Th$	white crystalline powder	195-206(dec.)		very s. boiling acetone, isoamyl alcohol, isohexanol, CS_2, CCl_4, $CHCl_3$, benzene, toluene, xylene, ethyl acetate, anisole, pyridine; difficulty s. boiling methanol, ethanol; i. boiling petroleum ether, ether	dec. in boiling THF, dioxane methyl benzoate		[76]J. prakt. Chem. 1 257	
$(MeCO-C_6H_6O-)_4Th$	white crystalline powder	193-194		very s. boiling isoamyl alcohol, isohexanol, CS_2, CCl_4, $CHCl_3$, benzene, toluene, xylene, ethyl acetate, anisole, pyridine; very difficulty s. boiling methanol, ethanol, acetone; i. boiling petroleum ether, ether	dec. in boiling THF, dioxane, methyl benzoate		[76]J. prakt. Chem. 1 257	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
 Th	yellowish white powder	207-210		very s. boiling CS_2, CCl_4, $CHCl_3$, benzene, toluene, xylene, dioxane, methyl benzoate, anisole, pyridine; very difficulty s. boiling isoamyl alcohol, isohexanol, ethyl acetate; i. boiling petroleum ether, ether, methanol, ethanol acetone	dec. in boiling THF		[76] J. prakt. Chem. 1 257	
 Th	white powder	192-198		very s. boiling ether, methanol, ethanol, acetone, isoamyl alcohol, isohexanol, CS_2, CCl_4 $CHCl_3$, benzene, toluene, xylene, dioxane, ethyl acetate, methyl benzoate, anisole, pyridine; i. boiling petroleum ether	dec. in boiling THF		[76] J. prakt. Chem. 1 257	
$(PhCOCHCOPh)_4Th$	yellow crystals [25,76,61,20]	196(dec.) [25] 202 [76] 192-193 [61] 200.5-201.5 [20] 190-191 [2]		very s. pyridine [25], boiling acetone, CS_2, CCl_4, $CHCl_3$, benzene, toluene, xylene, dioxane, ethyl acetate, anisole, pyridine, methyl benzoate [76], molten terphenyls [20] biphenyl [2]; s. acetone, ether benzene, toluene [25]; very difficulty s. boiling isoamyl alcohol, isohexanol [76]; i. water, ethanol [25], boiling petroleum ether, ether, ethanol, methanol [76]	dec. in boiling THF [76] good radiation stability [20] high thermal stability [20]	0.91 in benzene (ebulliometric) [76]	[25] ACS 3 1133 [76] J. prakt. Chem. 1 257 [61] Gazz. chim. ital. 79 731 [20] AERE C/M 320 [75] Acta Cryst. 10 605 [73] Acta Cryst. 11 301 [2] ORNL 2864	
$(PhCOCHCOCH_2Ph)_4$ Th	white glossy flakes	110		very s. boiling ether, acetone, isoamyl alcohol, isohexanol, CS_2, CCl_4, $CHCl_3$, benzene, toluene, xylene, dioxane, ethyl acetate, anisole, pyridine; very difficulty s. boiling methanol, ethanol; i. boiling petroleum ether	dec. in boiling THF, methyl benzoate		[76] J. prakt. Chem. 1 257	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
	yellow-white powder	222-224(dec.)		very s. boiling acetone, $CHCl_3$, benzene, toluene, xylene, THF, dioxane, ethyl acetate, anisole, pyridine; i. boiling petroleum ether, ether, methanol, ethanol, isoamyl alcohol, isohexanol, CS_2, CCl_4	dec. boiling methyl benzoate	0.98 in benzene (ebulliometric)	[78] J. prakt. Chem. 1 257	
	citron yellow crystals	280-295(dec.)		very s. boiling THF, dioxane, methyl benzoate, pyridine; difficulty s. boiling acetone, anisole; very difficulty s. boiling $CHCl_3$, benzene, toluene, xylene, ethyl acetate; i. boiling petroleum ether, ether, methanol, ethanol, isoamyl alcohol, isohexanol, CS_2, CCl_4			[78] J. prakt. Chem. 1 257	
	deep yellow crystals	242-244(dec.)		very s. boiling CCl_4, $CHCl_3$, benzene, toluene, xylene, dioxane, methyl benzoate, anisole, pyridine; difficulty s. boiling CS_2, ethyl acetate; very difficulty s. boiling acetone, isoamyl alcohol, isohexanol; i. boiling petroleum ether, ether, methanol, ethanol	dec. in boiling THF		[78] J. prakt. Chem. 1 257	
	yellow powder	214-215		very s. boiling acetone, CS_2, $CHCl_3$, THF benzene, toluene, xylene, dioxane, ethyl acetate, methyl benzoate, anisole, pyridine; difficulty s. boiling isoamyl alcohol isohexanol, CCl_4; i. boiling petroleum ether, ether, methanol, ethanol	dec. in boiling		[78] J. prakt Chem. 1 257	

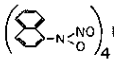
Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
	bright yellow powder	135-145(dec.)		very s. boiling acetone, $CHCl_3$, benzene, toluene, xylene, dioxane, ethyl acetate, methyl benzoate, anisole, pyridine; difficulty s. boiling isoamyl alcohol, isohexanol; i. boiling petroleum ether, ether, methanol, ethanol, CS_2, CCl_4	dec. in boiling THF		[78] J. prakt. Chem. 1 257	
	orange yellow powder	215-217(dec.)		very s. boiling $CHCl_3$, benzene, toluene, xylene, dioxane, methyl benzoate, anisole, pyridine; difficulty s. boiling acetone; very difficulty s. boiling isoamyl alcohol, isohexanol, CS_2, CCl_4, ethyl acetate; i. boiling petroleum ether, ether, methanol, ethanol	dec. in boiling THF		[78] J. prakt. Chem. 1 257	
	yellow crystalline powder	210-214(dec.)		very s. boiling CS_2, CCl_4, $CHCl_3$, benzene, toluene, xylene, dioxane, anisole, pyridine; difficulty s. boiling acetone, isoamyl alcohol, isohexanol, ethyl acetate; i. boiling petroleum ether, ether, methanol, ethanol	dec. in boiling THF, methyl benzoate		[78] J. prakt. Chem. 1 257	
	white powder	196-197		very s. boiling isoamyl alcohol, isohexanol, CS_2, CCl_4, $CHCl_3$ benzene, toluene, xylene, dioxane, ethyl acetate, anisole, pyridine; very difficulty s. boiling methanol, ethanol, acetone; i. boiling petroleum ether, ether	dec. in boiling THF, methyl benzoate		[78] J. prakt. Chem. 1 257	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
Uranium(IV)								
$(MeO)_4U$	green solid[42,48]	dec. without melting[42]	nonvolatile up to 300/0.01[48]	sparingly s. alcohol[42] i. methanol, benzene[48], ether[42]	oxidizes in air[42,48] dec. in water[42,48]	probably polymeric[48]	[42]JACS 78 4285 [48]AERE/EMR/PR 1044	
$(EtO)_4U$	light green solid	dec. without melting[42]	sublimes, 220/0.01[48]	slightly s. ethanol[42] i. ether[42]	oxidizes in air; dec. in water[1,42,48]		[42]JACS 78 4285 [48]AERE/EMR/PR 1044 [1]Chem. Ber. 85 267	
$(n\text{-}PrO)_4U$	green solid		sublimes, 240/0.01	i. dimethyl-cellosolve	oxidizes in air; dec. in water		[48]AERE/EMR/PR 1044	
$(i\text{-}PrO)_4U$	green solid		sublimes, 160/0.01	i. dimethyl-cellosolve	oxidizes in air; dec. in water		[48]AERE/EMR/PR 1044	
$[(i\text{-}PrO)_4Al]_4U$	grass-green viscous oil		95-97/0.001 143/1 269-271/761 (slight dec.)	s. pentane, hexane, cyclo-hexane, benzene alcohols	very stable thermally; oxidizes in air; dec. in water		[1]Chem. Ber 85 267	
$[(i\text{-}PrO)_4Al]_2UCl_2$	viscous olive-green oil		111-120/0.01 160-167/1	s. pentane, hexane, benzene, xylene, isopropyl alcohol	oxidizes in air; dec. in water		[1]Chem. Ber. 85 267	
$(t\text{-}BuO)_4U$	green crystals	dec.		s. petroleum ether	less sensitive to air oxidation than other U(IV) alkoxides		[42]JACS 78 4285	
$(Et_2MeSiO)_2UCl_2$	green solid		sublimes, 260/0.01		oxidizes in air		[48]AERE/EMR/PR 1044	
$(Et_2N)_4U$	emerald-green crystals	35.5-36.5	115-125/? (dec.)	s. benzene, ether, petroleum ether	oxidizes in air; dec. in water	0.90, 1.0 in benzene	[42]JACS 78, 4285	
$(BH_4)_4U$	dark green crystals		sublimes, v.p. = 0.30 mm (34.2°), 0.56 (40.2°), 1.23 (48.2°), 2.15 (54.3°), 4.00 (61.3°), 13.86 (79°)	slightly s. n-heptane, benzene s. ether (forms etherate)	fairly stable below 70°; stable in dry air; dec. by water, methanol, HCl	1.06 (v.p. method)	[66]JACS 75 219	
$(BH_4)_3(BH_3Me)U$	dark green crystals	85-95	sublimes, v.p. = 1.06 mm (25.1°), 2.13 (31.4°), 3.37 (38.1°), 5.56 (45.4°), 8.52 (50.7°), 14.6 (58.0°), 25.8 (65.6°)		dec. by water, HCl	1.09 (v.p. method)	[67]JACS 75 222	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(BH_3Me)_4U$	lavender-black crystals	72-74	sublimes, v.p. = 0.24 mm (40.1°), 0.34 (45.6°), 0.51 (53.2), 0.84 (60.3°), 1.03 (65.3°), 1.66 (70.6°), 1.93 (73.7°)		dec. by water, HCl		[67]JACS 75 222	
$(C_5H_5)_4U$	red crystals		nonvolatile	moderately s. benzene; sparingly s. pentane, hexane	dec. ~250° under N_2; slowly dec. by water	0.88 in benzene (cryoscopic)	[24]Z. Naturforsch. 17b 276	IR spectra; dipole moment (25°) in benzene = 0; magnetic moment = 2.78 ±0.07 B.M.
$(C_5H_5)_3UCl$	dark red crystals	260-265	sublimes above 180° in vacuo	s. THF, pyridine; sparingly s. CS_2, $CHCl_3$, CH_2Cl_2, water, 12N HCl; i. benzene, CCl_4, petroleum ether	thermally stable at 300°; dec. in air; slowly dec. by water, CS_2, $CHCl_3$ CH_2Cl_2		[58]JINC 2 246	magnetic data, 77-306°K IR and visible spectra
$(C_5H_5)_3(MeO)U$	green solid[85]		sublimes, 130/0.001[85]	s. petroleum ether[87]			[85]TID 19367 [87]TID 20123	originally thought to be $(C_5H_5)_3(MeO)_2U$[85], latest work indicates only one MeO group[87]
$(C_5H_5)_3(n\text{-}BuO)U$	dark green solid[84]	120-125[84]	sublimes, 100/0.0001[84]	s. THF, toluene; slightly s. petroleum ether[84]	dec. in air, water; very stable under high vac.[84]		[84]TID 18749 [85]TID 19367 [87]TID 20123	IR spectra[84]; originally thought to be $(C_5H_5)_3(n\text{-}BuO)_2U$ or $(C_5H_5)_3U{\cdot}2$ THF[84,85]; latest work indicates one n-BuO group[87]
$(C_5H_5)_3(PhO)U$?	green solid		sublimes, 140/0.0001				[85]TID 19367	reported as $(C_5H_5)_3(PhO)_2U$; however, later work on similar type compounds, $(C_5H_5)_3(MeO)U$ and $(C_5H_5)_3(n\text{-}BuO)U$, indicates only one alkoxy group
$(MeCOCHCHO)_4U$	solid	nonmelting at moderate temp.	nonvolatile at 130°		oxidizes in air		[58]JACS 75 2446	
$(MeCOCHCOMe)_4U$	green crystals[4,1]	176[4]; 175[1]; 173[28]; 175-176[58]; 177(dec)[25]	sublimes, 190/0.0001[1]; dec. when distilled[28]; v.p. = 0.0091 mm at 130°[58]	s. acetone, ether, ethanol, benzene, toluene, pyridine[28,25]; i. water[28]	oxidizes in air[1,28,58,25]; dec. by aq. acids, bases[28]		[4]Z. anorg. Chem. 40 218 [1]Chem. Ber. 85 267 [28]JACS 78 2790 [58]JACS 75 2446 [25]ACS 3 1133 [57]AECD 2659 [53]Disc. Faraday Soc. 9 125 (1950) [58]JCP 16 920 [30]Acta Cryst. 12 817	IR spectra[57,58] magnetic data, 75-330°K[58]; crystal data[30]

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(MeCOCHCOEt)_4U$	solid	63[28]; 59-60[68]	142/0.0002[28]; v.p. = 0.02-0.04 mm at 130°[68]	s. organic solvents[28]; i. water[28]	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790 [68]JACS 75 2446	
$(MeCOCHCOn\text{-}Pr)_4U$	liquid		158/0.001	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(MeCOCHCOi\text{-}Pr)_4U$	liquid		155/0.001[28] dec., 130°[68]	s. organic solvents[28]; i. water[28]	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790 [68]JACS 75 2446	
$(MeCOCHCOn\text{-}Bu)_4U$	liquid		175/0.001	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(MeCOCHCOt\text{-}Bu)_4U$	liquid[28] solid[68]	dec.[68]	158/0.002[28] v.p. = 0.019 mm at 130°[68]	s. organic solvents[28]; i. water[28]	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790 [68]JACS 75 2446	
$(MeCOCHCOn\text{-}Am)_4U$	liquid		180/0.0001	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(MeCOCHCOn\text{-}Hex)_4U$	liquid		dec. when distilled	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(MeCOCHCOPh)_4U$	red-brown solid[25,60,1]	206(dec.)[28]; 190-195[68]; ~210(dec.)[25]; 197-198[60]		s. pyridine; slightly s. benzene; very slightly s. ether, ethanol, toluene[25]; i. water[28,25]	oxidizes in air[28,68,25]; dec. by acids, bases[28]		[28]JACS 78 2790 [68]JACS 75 2446 [25]ACS 3 1133 [60]Atti accad. Lincei 6 639 [1]Chem. Ber. 85 267	magnetic data, 22.1°C[60]
$(MeCOCHCOCH_2OEt)_4U$	solid	80	dec. when distilled	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$\left(MeCOCHCO\text{-}\langle\rangle\right)_4U$	solid	225[28] 195[68]	v.p. too small for measurement at 130°[68]	s. organic solvents[28] i. water[28]	oxidizes in air[28,68]; dec. by acids, bases[28]		[28]JACS 78 2790 [68]JACS 75 2446	
$(EtCOCHCOEt)_4U$	solid	63[28] 64-65[68]	145/0.0002[28] v.p. = 0.0077 mm at 130°[68]	s. organic solvents[28]; i. water[28]	oxidizes in air[28,68] dec. by acids, bases[28]		[28]JACS 78 2790 [68]JACS 75 2446	
$(n\text{-}PrCOCHCOn\text{-}Pr)_4U$	solid	21	170/0.0003	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(PhCOCHCHO)_4U$	solid	131-133(dec.)	dec. when distilled		oxidizes in air		[68]JACS 75 2446	
$(PhCOCHCOPh)_4U$	black-violet rods[1] red-brown powder[25]	192-193[1]; 168[28]; 198-199 (dec.)[25]; 185-186[60]		s. benzene[1,28]; acetone, ether, pyridine[25]; slightly s. ethanol[25]; i. water[28,25]	oxidizes in air[1,28]; dec. by acids, bases[28]		[1]Chem. Ber. 85 267 [28]JACS 78 2790 [25]ACS 3 1133 [60]Atti accad. Lincei 6 639 [75]Acta Cryst 10, 605	magnetic data at 22.1°C[60] crystal data[75]

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$\left(PhCOCHCO-\langle\rangle\right)_4U$	brown-maroon crystals	206-207		s. organic solvents; i. water			[80]Atti accad. Lincei 6 639	magnetic data, 21.5°C
$\left(PhCOCHCO-\langle N\text{-}Me\rangle\right)_4U$	black-maroon solid	245-246 (dec.)		s. organic solvents; i. water			[80]Atti accad. Lincei 6 639	magnetic data, 21.7°C
$\left(PhCOCHCO-\langle N\rangle\right)_4U$	black-maroon crystals	265-266(dec.)		s. organic solvents; i. water			[80]Atti accad. Lincei 6 639	magnetic data, 21.7°C
$(CF_3COCHCOMe)_4U$	khaki-green solid[34]	146[28] 138-140[68]	sublimes, 100-110/ 0.0001[34]; v.p. = 0.08 mm at 130°[68]	s. organic solvents[28]; i. water[28]	oxidizes in air[28,68] dec. by acids, bases[28]		[28]JACS 78 2790 [68]JACS 75 2446 [34]JCS 609 (1951)	uv spectra[34]
$(CF_3COCHCOCF_3)_4U$	brown crystals	60[28]; ~90[34]	70/0.001[28]; 145(dec)[34]; sublimes, 40-50/0.001, 70-80/0.2 (dec.)[34]	s. organic solvents; i. water, cold dil. HCl[28]	oxidizes in air; dec. by acids, bases; thermally unstable[28]		[28]JACS 78 2790 [34]JCS 609 (1951)	
$(CF_3COCHCOEt)_4U$	solid	60	116/0.001	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(CF_3COCHCOn\text{-}Pr)_4U$	solid	15	132/0.001	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(CF_3COCHCOi\text{-}Pr)_4U$	solid	78	134/0.003	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(CF_3COCHCOn\text{-}Bu)_4U$	liquid		142/0.005	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(CF_3COCHCOi\text{-}Bu)_4U$	solid	82	141/0.002	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(CF_3COCHCOt\text{-}Bu)_4U$	solid	136[28] 138[68]	145/0.0002[28]; v.p. = 0.068 mm at 130°[68]	s. organic solvents[28]; i. water[28]	oxidizes in air[28,68]; dec. by acids, bases[28]		[28]JACS 78 2790 [68]JACS 75 2446	
$(CF_3COCHCOn\text{-}Am)_4U$	liquid		166/0.004	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(CF_3COCHCOPh)_4U$			191/0.003	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(CF_3COCHCOOMe)_4U$		90	114/0.0002	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(CF_3COCHCOOEt)_4U$		65[28] 61[68]	123/0.0008[28]; v.p. = 0.02 mm at 130°	s. organic solvents; i. water[28]	oxidizes in air[28,68]; dec. by acids, bases[28]		[28]JACS 78 2790 [68]JACS 75 2446	
$(CF_3COCHCOOn\text{-}Bu)_4U$	liquid		162/0.008	s. organic solvents; i. water	oxidizes in air; dec. by acids, bases		[28]JACS 78 2790	
$(PhN(NO)O)_4U$	yellow solid	161(dec.)					[80]Atti accad. Lincei 6 639	magnetic susceptibility at 21.8°C
	olive crystals	161(dec.)					[80]Atti accad. Lincei 6 639	magnetic susceptibility at 21.8°C
$(EtS)_4U$	light green solid	dec.		i. ether	pyrophoric; dec. by water		[42]JACS 78 4285	
$(n\text{-}BuS)_4U$		dec.			pyrophoric; dec. by water		[42]JACS 78 4285	
Uranium(V)								
$(MeO)_5U$	rust-colored crystals[14,48,16] red crystalline solid[44]		sublimes, 140-150/ 0.01[14,48,16]; sublimes, 190-210/ 0.01[44]	s. benzene, ether, methanol petroleum ether[14,48,44]	dec. by water[14,48,44]	3.01 in benzene[14,48,16] (ebullioscopic)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044 [16]JINC 4 279 [44]JACS 78 4289	
$(MeO)_3\{CF_3COCH COOEt\}_2U$	green liquid		95-97/0.002	s. methanol			[45]JACS 78 6027	
$(EtO)_5U$	brown, mobile liquid		161/0.05, 180/ 0.1[14,48,43]; 123/0.001, 134/0.005, 145/0.01, 160/0.05[43]	s. ethanol, ether, benzene, petroleum ether[14,48,43], ethyl acetate, CCl_4, $CHCl_3$, CS_2, pyridine, 1,4-dioxane, mineral oil, tetraethyl-lead, nitrobenzene, epichlorohydrin[43]; i. acetonitrile[43]	stable below 170°[43]; dec. by water[43]	1.90 in benzene (ebullio-metric[14,48,16]; 1.84 in benzene (cryoscopic)[43]; 2.03 in naphthalene (cryoscopic)[43]; 2.384 (1.140 molal benzene), 1.853 (0.320 molal benzene), 1.713 (0.1519 molal benzene), 1.563 (0.0815 molal benzene), (cryoscopic)[79]	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044 [16]JINC 4 279 [43]JACS 78 4287 [79]TID 5290	$d_{25°} = 1.711$[43]; summary of measured properties[79]
$(EtO)_4UCl$	brown liquid		140-147/0.003 145-150/0.005	s. ethanol, ether, benzene, petroleum ether		1.96, 1.78 in benzene (cryoscopic)	[45]JACS 78 6027	
$(EtO)_3UCl_2$	green sirupy liquid		dec.	s. non-polar solvents			[45]JACS 78 6027	
$(EtO)_2UCl_3$	green liquid		dec.	s. organic solvents			[45]JACS 78 6027	
$[(EtO)_6U]Na$	green crystalline solid	dec. without melting	nonvolatile, dec. under reduced pressure	s. alcohol, ether; sparingly s. benzene, petroleum ether	dec. by water		[45]JACS 78 6027	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$[(EtO)_6U]_2Ca$	light green solid		sublimes, 200/0.001	s. ethanol; i. petroleum ether			[45] JACS 78 6027	
$[(EtO)_5U]_3Al$	green liquid		111-115/0.0012	s. ethanol			[45] JACS 78 6027	
$(EtO)_3(CF_3COCHCOOMe)_2U$			93-95/0.001	s. ether			[45] JACS 78 6027	
$(EtO)_3(CF_3COCHCOOEt)_2U$	green liquid		95-98/0.001 100-105/0.004	s. ether			[45] JACS 78 6027	
$(EtO)_3(CF_3COCHCOOn\text{-}Bu)_2U$			110/0.005	s. ether			[45] JACS 78 6027	
$(CF_3CH_2O)_5U$	brown-green crystalline solid		130/0.008	s. ether, benzene, petroleum ether	dec. by water		[44] JACS 78 4289	
$(CF_3CH_2O)_5U\cdot 3Me_2NH$	green liquid		95-100/0.01	s. ether	thermally unstable		[45] JACS 78 6027	
$(CF_3CH_2O)_5U\cdot 2Me_3N$	green liquid		95-100/0.02	s. ether	thermally unstable		[45] JACS 78 6027	
$(CF_3CH_2O)_5U\cdot 2n\text{-}PrNH_2$	green liquid		105-107/0.009	s. ether	thermally unstable		[45] JACS 78 6027	
$(CF_3CH_2O)_5U\cdot 2i\text{-}PrNH_2$	green liquid		100-103/0.01	s. ether	thermally unstable		[45] JACS 78 6027	
$(CF_3CH_2O)_5U\cdot 2n\text{-}Pr_2NH$	green liquid		97-100/0.006	s. ether	thermally unstable		[45] JACS 78 6027	
$(CF_3CH_2O)_5U\cdot 3CH_2(CH_2)NH$	green liquid		125-128/0.002	s. ether	thermally unstable		[45] JACS 78 6027	
$(n\text{-}PrO)_5U$	brown, mobile liquid		181/0.07[14,48,18]; 151-152/0.0003, 162-164/0.001, 173-175/0.006[44]	s. benzene, ether, alcohol, petroleum ether[14,48,44]	thermally stable[44]; dec. by water[44]	1.95 in benzene[14,48,18] (ebulliometric)	[14] JCS 1023 (1963) [48] AERE/EMR/PR 1044 [18] JINC 4 279 [44] JACS 78 4289	
$(n\text{-}PrO)_4UCl$	green liquid		186-192/0.095	s. non-polar solvents			[45] JACS 78 6027	
$(i\text{-}PrO)_5U$	brown solid	320(dec.)[44]	sublimes, 150/0.05[14,48,15]; 160/0.01[44]	s. ether, benzene, petroleum ether isopropanol	dec. by water[44]	1.93 in benzene[14] (ebulliometric)	[14] JCS 1023 (1963) [48] AERE/EMR/PR 1044 [15] JINC 3 367 [44] JACS 78 4289	
$(CH_2{=}CHCH_2O)_5U$	dark brown liquid		175-180/0.015 (dec.)	s. ether, benzene, petroleum ether	dec. by water		[44] JACS 78 4289	
$(n\text{-}BuO)_5U$	brown mobile liquid		206/0.15[14,48,18]; 192-194/0.001, 205-207/0.008[44]	s. benzene, ether, petroleum ether[14,48,44] alcohol[14,48]	dec. by water[44]	1.94 in benzene[14,48,18] (ebulliometric)	[14] JCS 1023 (1963) [48] AERE/EMR/PR 1044 [18] JINC 4 279 [44] JACS 78 4289	

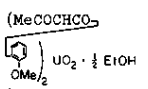
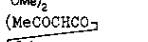
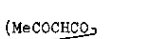
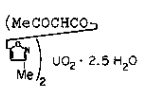
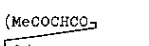
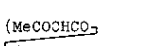
Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(i\text{-BuO})_5U$	brown solid	100-104[44]	192/0.01[14,48]; 192/0.009[44]	s. alcohol, ether, benzene, petroleum ether	dec. by water[44]	1.97 in benzene[14,48] (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044 [44]JACS 78 4289	
$(sec\text{-BuO})_5U$	brown solid	85[44]	sublimes, 175/0.05[14,48]; 175-180/0.008, 180-185/0.009[44]	s. ether, benzene, petroleum ether	dec. by water	1.85 in benzene[14,48] (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044 [44]JACS 78 4289	
$(t\text{-BuO})_5U$	rust-colored crystalline solid[14,48]; tan, crystalline solid[44]		sublimes, 120/0.05[14,48] not sublimed?[44]	s. benzene, ether, petroleum ether	dec. by water	1.35 in benzene[14,48] (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044 [44]JACS 78 4289	
$(t\text{-BuO})_5U\cdot t\text{-BuOH}$	brown crystals[14,48]; red-brown crystalline solid[49]		sublimes 130/0.1[14,48]; 66/0.00001 (dec.)[48]	s. alcohols, benzene, CCl_4[49]	oxidizes in air; dec. by water[49]	0.93 in benzene[14,48] (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044 [49]Karraker, SRL	visible and IR spectra[49]
$(t\text{-BuO})_3UO\cdot t\text{-BuOH}$	greyish-brown crystals		sublimes, 130/0.1(dec.)	s. petroleum ether			[48]AERE/EMR/PR 1044	obtained in attempted preparation of uranium tetra-t-butoxide
$(t\text{-BuO})_5U\cdot C_5H_5N$	brown solid		sublimes (dec.)	s. organic solvents			[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	IR absorption peaks
$(t\text{-BuO})_4(EtO)U$	brown solid			s. organic solvents			[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(t\text{-BuO})_6(EtO)_4U_2$	tan crystalline solid		sublimes, 150/0.1	s. organic solvents			[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(t\text{-BuO})_5(EtO)_5U_2$	tan solid		sublimes, 150°/0.1	s. organic solvents			[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(t\text{-BuO})_2(EtO)_3U$	tan solid		sublimes, 150/0.1	s. benzene, ether, petroleum ether	dec. by water	1.91 in benzene (ebulliometric)	[48]AERE/EMR/PR 1044	
$(CF_3CH_2SCH_2CH_2O)_5U$	dark brown liquid		not distilled	s. ether, benzene, petroleum ether	dec. by water		[44]JACS 78 4289	
$(n\text{-AmO})_5U$	brown, mobile liquid		246/0.05	s. alcohol, ether benzene[14,48]	dec. by water[14]	1.94 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044 [16]JINC 4 279	
$(i\text{-AmO})_5U$	brown, mobile liquid		225/0.05	s. alcohol, ether, benzene	dec. by water	1.76 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(neo\text{-AmO})_5U$ $([Me_3CCH_2O]_5U)$	rust-colored crystalline solid		sublimes, 160-170/0.1	s. alcohol, ether, benzene	dec. by water	1.61 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(act\text{-AmO})_5U$ $([MeEtCHCH_2O]_5U)$	brown, mobile liquid		220/0.05	s. alcohol, ether, benzene	dec. by water	1.82 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(n\text{-PrMeCHO})_5U$	brown viscous liquid		175/0.1	s. organic solvents	dec. by water	1.70 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(i\text{-PrMeCHO})_5U$	brown solid		sublimes, 160/0.1	s. organic solvents	dec. by water	1.58 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(Et_2CHO)_5U$	brown solid		sublimes, 180/0.1	s. organic solvents	dec. by water	1.66 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(t\text{-AmO})_3U$ $([Me_2EtCO]_5U)$	brown solid		sublimes, 130/0.05	s. benzene, ether, petroleum ether	dec. by water	1.26 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(n\text{-PrMe}_2CO)_5U$	brown, mobile liquid[48] brown solid[14]		200/0.1	s. benzene, ether, petroleum ether	dec. by water	1.28 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(i\text{-PrMe}_2CO)_5U$	brown liquid[48] brown solid[14]		dec. when distilled	s. benzene, ether, petroleum ether	dec. by water		[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(Et_2MeCO)_5U$	brown solid		sublimes, 200/0.1	s. benzene, ether, petroleum ether	dec. by water	1.09 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(Et_2NCH_2CH_2O)_5U$	dark brown liquid		not distilled	s. ether, benzene, petroleum ether	dec. by water		[42]JACS 78 4285	
$(i\text{-PrEtMeCO})_5U$	brown solid		dec. when distilled	s. ether, benzene, petroleum ether	dec. by water	1.01 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(Et_3CO)_5U$	brown solid		210/0.1	s. benzene, ether, petroleum ether	dec. by water	1.00 in benzene (ebulliometric)	[14]JCS 1023 (1963) [48]AERE/EMR/PR 1044	
$(Me_3SiO)_5U$	yellowish brown solid		sublimes, 140-150/0.1	s. benzene, hexamethyl-disiloxane	fairly resistant to hydrolysis; good thermal stability; stable to oxidation	1.77 in benzene (ebulliometric)	[13]JCS 204 (1963) [48]AERE/EMR/PR 1044	
$(Me_2EtSiO)_5U$	yellowish-brown solid		sublimes, 155/0.1	s. benzene, hexamethyl-disiloxane	fairly resistant to hydrolysis; good thermal stability; stable to oxidation	1.31 in benzene; (ebulliometric)	[13]JCS 204 (1963) [48]AERE/EMR/PR 1044	
$(MeEt_2SiO)_5U$	orange solid		sublimes, 160/0.1	s. benzene, hexamethyl-disiloxane	fairly resistant to hydrolysis; good thermal stability; stable to oxidation	1.13 in benzene; (ebulliometric)	[13]JCS 204 (1963) [48]AERE/EMR/PR 1044	
$(Et_3SiO)_5U$	greenish-brown solid		sublimes, 170-180/0.1	s. benzene, hexamethyl-disiloxane	fairly resistant to hydrolysis; good thermal stability; stable to oxidation	1.00 in benzene (ebulliometric)	[13]JCS 204 (1963) [48]AERE/EMR/ PR 1044	

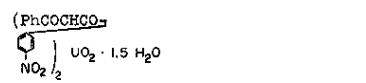
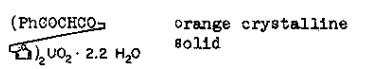
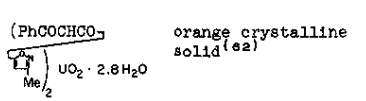
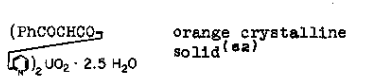
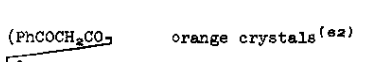
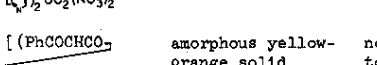
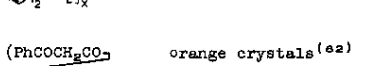
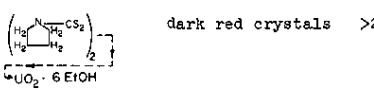
Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
Uranium(VI)								
$(MeO)_6U$	red crystalline solid	62-64	87/0.01, 96-98/0.5	s. methanol	thermally unstable	predominantly dimeric	[46] JACS 78 6030	
$(EtO)_6U$	red liquid		74-76/0.003, 93/0.18[46]; 140/0.1[46]	s. benzene, ether, ethanol petroleum ether[46]	thermally unstable[46]; dec. by water[46]	1.21, 1.24 (cryoscopic)	[46] JACS 78 6030 [48] AERE/EMR/PR 1044	d = 1.563[46]
$(EtO)_5UCl$	red-brown liquid		104-107/0.007	s. ether			[46] JACS 78 6030	
$(n\text{-}PrO)_6U$	red liquid		105-107/0.001, 115/0.004 (dec.)	s. n-propanol	thermally unstable		[46] JACS 78 6030	
$(i\text{-}PrO)_6U$	dark red crystalline solid[46]	167-168[46]	sublimes, 65/0.01[17]; 135/0.004[46]	s. isopropyl alcohol[46]	thermally unstable[46]	1.1 in benzene[17] (ebulliometric)	[17] JINC 12 71 [46] JACS 78 6030	
$(n\text{-}BuO)_6U$	red liquid		dec. when distilled	s. n-butyl alcohol			[46] JACS 78 6030	
$(s\text{-}BuO)_6U$			sublimes, 75/0.01			1.0 in benzene (ebulliometric)	[17] JINC 12 71	
$(t\text{-}BuO)_6U$	purple solid[49]		sublimes, 85/0.01[17]; 90/0.00001 (dec.)[49]	s. alcohols, benzene, carbon tetrachloride[49]	resistant to hydrolysis[17, 49] stable in dry air[17]	1.0 in benzene (ebulliometric)[17]	[17] JINC 12 71 [49] Karraker, SRL	visible and IR spectra[49]
$(t\text{-}AmO)_6U$ $([Me_2EtCO])_6U)$	red solid		sublimes, 120/0.1				[48] AERE/EMR/PR 1044	
$(Me_3SiO)_6U$	orange solid		sublimes, 145-150/0.1	s. benzene, hexamethyl-disiloxane	moderately stable to hydrolysis; poor thermal stability	1.05 in benzene (ebulliometric)	[13] JCS 204 (1963) [48] AERE/EMR/PR 1044	
$(Me_2EtSiO)_6U$	orange solid		sublimes, 160-165/0.1	s. benzene, hexamethyl-disiloxane	moderately stable to hydrolysis; poor thermal stability	0.98 in benzene (ebulliometric)	[13] JCS 204 (1963) [48] AERE/EMR/PR 1044	
$(MeEt_2SiO)_6U$	red solid		sublimes, 175/0.1	s. benzene, hexamethyl-disiloxane	moderately stable to hydrolysis; poor thermal stability	1.00 in benzene (ebulliometric)	[13] JCS 204 (1963) [48] AERE/EMR/PR 1044	
$(Et_3SiO)_6U$	red solid		sublimes, 195/0.05	s. benzene, hexamethyl-disiloxane	moderately stable to hydrolysis; poor thermal stability	0.97 in benzene (ebulliometric)	[13] JCS 204 (1963) [48] AERE/EMR/PR 1044	
$(MeO)_2UO_2 \cdot MeOH$	bright yellow microcrystalline solid			sparingly s. methanol	thermally unstable; loses MeOH at 100°/0.05	probably polymeric	[17] JINC 12 71 [18] Proc. Chem. Soc. 260 (1957)	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(EtO)_2UO_2 \cdot 2EtOH$	light brown powder			sparingly s. benzene, ethanol	thermally unstable; loses EtOH at 80°/0.05 mm; dec. at 100°/0.05 mm	probably polymeric	[17] JINC 12 71	
$(EtO)_2UO_2 \cdot 3EtOH$	yellow-brown crystalline solid			s. ethanol, ether	thermally stable; retained EtOH at 200°/0.0004 mm; dec. by water		[47] JACS 79 4921	
$(n\text{-}PrO)_2UO_2$	cream-colored crystalline solid			sparingly s. n-propanol		probably polymeric	[17] JINC 12 71	
$(i\text{-}PrO)_2UO_2 \cdot i\text{-}PrOH$					undergoes solvolytic disproportionation to (a) and (b)		[18] Proc. Chem. Soc. 260 (1957). [17] JINC 12 71	
(a) $(i\text{-}PrO)_4UO \cdot i\text{-}PrOH$	deep red crystalline solid			s. isopropanol, isopropanol-benzene	undergoes thermal disproportionation to (b) and $(i\text{-}PrO)_6U$			
(b) $(i\text{-}PrO)_2U_2O_5 \cdot 2i\text{-}PrOH$	red-brown solid		nonvolatile	i. isopropanol				
$(i\text{-}BuO)_2UO_2 \cdot i\text{-}BuOH$	crystalline solid			sparingly s. isobutanol		probably polymeric	[17] JINC 12 71	
$(s\text{-}BuO)_4UO \cdot s\text{-}BuOH$	red solid			s. s-butanol-benzene	undergoes thermal disproportionation 110-125°/0.05 mm		[17] JINC 12 71	
$(t\text{-}BuO)_2UO_2 \cdot 4t\text{-}BuOH$	red crystalline solid			partially s. petroleum ether			[47] JACS 79 4921	
$(t\text{-}BuO)_4UO \cdot t\text{-}BuOH$	red crystalline solid			s. t-butanol-benzene	undergoes thermal disproportionation at 110°/0.05 mm		[17] JINC 12 71	
$(i\text{-}AmO)_2UO_2$	deep red solid [17]		nonvolatile [1]	s. heptane, benzene, cyclohexane [1]; i. benzene [17]	dec. by uv light [1]	probably polymeric	[17] JINC 12 71 [1] Chem. Ber. 85 267	
$(i\text{-}AmO)_2UO_2 \cdot i\text{-}AmOH$	brown solid			s. benzene-isoamyl alcohol	loses i-AmOH at 78°/0.05 mm	probably polymeric	[17] JINC 12 71	
$(t\text{-}AmO)_2UO_2$	deep maroon crystalline solid		nonvolatile up to 120/0.05	s. t-amyl alcohol; i. benzene	dec. at 135°/0.05 mm	probably polymeric	[17] JINC 12 71	
$(MeCOCHCOH)_2UO_2$		nonmelting (at usual temp.)	nonvolatile at 130°				[68] JACS 75 2446	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(MeCOCHCOMe)_2$ UO_2	yellow-orange solid	dec. without melting 230-235, 225-250[68]	nonvolatile at 130°[68]	moderately s. in benzene, acetone, toluene, alcohol, carbon tetrachloride[68]	dec. by water[21]	1.95 in benzene (ebulliometric)[19]	[68]JACS 75 2446 [21]JCS 4655 (1958) [19]Gazz. chim. ital. 89 939 [32]Trudy Radievogo Inst. im. V. G. Khlopina 7 5	IR spectra[21] visible and uv spectra[21,19]; dipole moment in benzene = 5.12D[32]
$(MeCOCHCOMe)_2$ $UO_2 \cdot H_2O$	orange-yellow crystals[4]		dec. when distilled[28]	s. ethanol[28]			[4]Z. anorg. Chem. 40 218 [28]JACS 78 2790 [64]JCS 4257 (1958) [21]JCS 4655 (1958)	IR spectra[64,21]; crystal data[21]; visible spectra[21]; magnetic data at 25°C[21]
$(MeCOCHCOMe)_2$ $UO_2 \cdot MeCOCH_2COMe$	orange plates						[21]JCS 4655 (1958)	
$(MeCOCHCOMe)_2$ $UO_2 \cdot MeCOPh$	orange crystals						[21]JCS 4655 (1958)	
$(MeCOCHCOMe)_2$ $UO_2 \cdot NH_3$							[64]JCS 4257 (1958)	IR spectra
$(MeCOCHCOMe)_2$ $UO_2 \cdot C_5H_5N$	orange yellow crystals[33]			s. methanol, ethanol[33]; sparingly s. ether, water[33]			[33]Z. anorg. allgem. Chem. 162 82 [64]JCS 4257 (1958)	IR spectra[64]
$(MeCOCHCOMe)_2$ $UO_2 \cdot C_6H_6$	orange yellow crystalline powder			s. methanol, ethanol; difficulty s. ether, water			[33]Z. anorg. allgem. Chem. 162 82	
$(MeCOCHCOEt)_2$ UO_2	yellow solid[28]	218-219[28] 206-208[68]	dec. when distilled[28]	s. ethanol[28]			[28]JACS 78 2790 [68]JACS 75 2446	
$(MeCOCHCOn\text{-}Pr)_2$ UO_2	yellow solid	85-86	dec. when distilled	s. ethanol			[28]JACS 78 2790	
$(MeCOCHCOi\text{-}Pr)_2$ UO_2		112-115	nonvolatile at 130°				[68]JACS 75 2446	
$(MeCOCHCOt\text{-}Bu)_2$ UO_2		150-152	nonvolatile at 130				[68]JACS 75 2446	
$(MeCOCHCOn\text{-}Am)_2$ UO_2	yellow solid	95-96	dec. when distilled	s. ethanol			[28]JACS 78 2790	
$(MeCOCHCOn\text{-}Hex)_2$ UO_2	yellow solid	76-78	dec. when distilled	s. ethanol			[28]JACS 78 2790	
$(MeCOCHCOPh)_2$ UO_2		157-158[60]	nonvolatile at 130[68]				[68]JACS 75 2446 [64]JCS 4257 (1958) [32]Trudy Radievogo Inst. im.V.G. Khlopina 7 5	IR spectra[64] dipole moment = 3.12D in benzene, 3.09D in CCl_4[32]

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(MeCOCHCOPh)_2$ $UO_2 \cdot 2.5H_2O$	orange crystalline solid[62]	258-259[62]		s. methanol, ethanol, acetone, ethyl ether[62], pyridine[4]; i. CS_2, CCl_4[62]	turns red above 120°[62]		[62]JCS 2368 (1954) [63]JCS 2751 (1954) [64]JCS 4257 (1958) [39]Yokugaku Zasshi 77 386	uv spectra[63]; IR spectra[64]; visible[62,39] spectra
$(MeCOCHCOPh)_2$ $UO_2 \cdot EtOH$	yellow solid	120(dec.)	dec. when distilled	s. ethanol			[28]JACS 78 2790	
$(MeCOCHCOPh)_2$ $UO_2 \cdot NH_3$	yellow crystals[62]	162-164 (dec.)[62]			turns red above 120°[62]		[62]JCS 2368 (1954) [64]JCS 4257 (1958)	IR spectra[64]
$(MeCOCHCOPh)_2$ $UO_2 \cdot C_5H_5N$	orange solid[62]	242-243 (dec.)[62]					[62]JCS 2368 (1954) [64]JCS 4257 (1958)	IR spectra[64]
	yellow solid	171-172	dec. when distilled	s. ethanol			[28]JACS 78 2790	
		172-175	nonvolatile at 130°				[68]JACS 75 2446	
	yellow solid	75-76	dec. when distilled	s. ethanol			[28]JACS 78 2790	
	orange crystalline solid[62]			s. methanol, ethanol, ether, acetone; i. CS_2, CCl_4[62]	dec. 190-205[62]		[62]JCS 2368 (1954) [63]JCS 2751 (1954)	visible and uv spectra[63]
	orange crystalline solid[62]			s. methanol, ethanol, acetone ether; i. CS_2, CCl_4[62]	dec. 182-183[62]		[62]JCS 2368 (1954) [63]JCS 2751 (1954)	visible and uv spectra[63]
	orange crystalline solid[62]	nonmelting up to 270[62]		s. methanol, ethanol, acetone, ether; i. CS_2, CCl_4[62]			[62]JCS 2368 (1954) [63]JCS 2751 (1954)	visible and uv spectra[63]
$(EtCOCHCOEt)_2$ $UO_2 \cdot EtOH$	yellow solid	83-84	dec. when distilled	s. ethanol			[28]JACS 78 2790	
$(n\text{-}PrCOCHCOH)_2$ UO_2	yellow solid	122 (dec.)	dec. when distilled	s. ethanol			[28]JACS 78 2790	
$(n\text{-}PrCOCHCOn\text{-}Pr)_2UO_2$	yellow solid	71-72	dec. when distilled	s. ethanol			[28]JACS 78 2790	
$(t\text{-}BuCOCHCOH)_2$ UO_2		100	nonvolatile at 130°				[68]JACS 75 2446	
$(PhCOCHCOH)_2$ UO_2		140-145	nonvolatile at 130°				[68]JACS 75 2446	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$(PhCOCHCOPh)_2$ UO_2	reddish-orange crystals	223-225 (dec.)[1]		s. ketones, esters, pyridine; fairly s. ethanol, less s. in higher alcohols; slightly s. ethyl ether; i. benzene, toluene, xylene, gasoline[29]	stable in water; dec. by acid, alkali, ammonia[29]; discolored at 180°C, dec. 245[29]		[29]Z. Naturforsch. 1 377 [1]Chem. Ber. 85 267	
$(PhCOCHCOPh)_2 \cdot UO_2 \cdot 2.5H_2O$	orange crystalline solid[62] red crystals	267-271 (dec.)[62] 270-274 (dec.)[20]		s. methanol, ethanol, ether, acetone[62] pyridine[39], molten terphenyls[20]; i. CS_2, CCl_4[62]	turns red above 140°[62]; darkens above 150°[20]; good radiation stability[20]		[62]JCS 2368 (1954) [63]JCS 2751 (1954) [64]JCS 4257 (1958) [20]AERE C/M 320 [39]Yokugaku Zasshi 77 386	visible spectra[63,64]; uv spectra[63]; IR spectra[64]
$(PhCOCHCOPh)_2$ $UO_2 \cdot 1/2EtOH$	yellow solid	>230	dec. when distilled	s. ethanol			[28]JACS 78 2790	
$(PhCOCHCOPh)_2$ $UO_2 \cdot NH_3$	orange crystals[62]				turns red above 140°; dec. at 215°[62]		[62]JCS 2368 (1954) [64]JCS 4257 (1958)	IR spectra[64]
$(PhCOCHCOPh)_2$ $UO_2 \cdot C_5H_5N$	orange yellow powder[33]	235-245 (dec.)[62]		s. methanol, slightly s. ethanol, ether; i. water[33]			[33]Z. anorg. allgem. chem. 162 82 [62]JCS 2368 (1954) [64]JCS 4257 (1958)	IR spectra[64]
$(PhCOCHCO\text{-}C_6H_4\text{-}OMe)_2 UO_2$				s. alcohols, diethyl ether, pyridine			[39]Yokugaku Zasshi, 77 396	visible spectra
$(PhCOCHCO\text{-}C_6H_4\text{-}OMe)_2 UO_2$				s. alcohols, diethyl ether, pyridine			[39]Yokugaku Zasshi 77 396	visible spectra
$(PhCOCHCO\text{-}C_6H_4\text{-}OMe)_2 UO_2$				s. alcohols, diethyl ether, pyridine			[39]Yokugaku Zasshi 77 396	visible spectra
$(PhCOCHCO\text{-}C_6H_4\text{-}NH_2)_2 UO_2$				s. alcohols, diethyl ether, pyridine			[39]Yokugaku Zasshi 77 391	visible spectra
$(PhCOCHCO\text{-}C_6H_4\text{-}NH_2)_2 UO_2$				s. alcohols, diethyl ether, pyridine			[39]Yokugaku Zasshi 77 391	visible spectra
$(PhCOCHCO\text{-}C_6H_4\text{-}NO_2)_2 UO_2$				s. alcohols, diethyl ether, pyridine			[39]Yokugaku Zasshi 77 391	visible spectra
$(PhCOCHCO\text{-}C_6H_4\text{-}NO_2)_2 UO_2 \cdot 1.5 H_2O$				s. alcohols, diethyl ether, pyridine			[39]Yokugaku Zasshi 77 391	visible spectra

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
				s. alcohols, diethyl ether, pyridine			[38] Yokugaku Zasshi, 77, 391	visible spectra
				alcohols, diethyl ether, pyridine; sparingly s. water			[38] Yokugaku Zasshi, 77 386	visible spectra
	orange crystalline solid			s. methanol, ethanol, ether, acetone; i. CS_2 CCl_4	dec. above 150		[62] JCS 2368 (1954)	
	orange crystalline solid[62]	nonmelting up to 280[62]		s. methanol, ethanol, ether, acetone; i. CS_2, CCl_4[62]	no dec. up to 280°[62]		[62] JCS 2368 (1954) [63] JCS 2751 (1954)	visible and uv spectra[63]
	orange crystalline solid[62]			s. methanol, ethanol, ether, acetone; i. CS_2 CCl_4[62]	dec. above 215°[62]		[62] JCS 2368 (1954) [63] JCS 2751 (1954)	visible and uv spectra[63]
	orange crystals[62]			s. alcohol, acetone, water-saturated ether[62]	dec. above 170°[62]		[62] JCS 2368 (1954) [63] JCS 2751 (1954)	visible and uv spectra[63]
	amorphous yellow-orange solid	nonmelting up to 350		sparingly s. pyridine; i. water, all inert organic solvents	no dec. at 350°		[62] JCS 2368 (1954)	
	orange crystals[62]			s. alcohol, acetone, water-saturated ether[62]	dec. 210°[62]		[62] JCS 2368 (1954) [63] JCS 2751 (1954)	visible and uv spectra[63]
				s. alcohols, diethyl ether, pyridine; sparingly s. water			[38] Yokugaku Zasshi, 77 386	visible spectra
$(CF_3COCHCOMe)_2UO_2$	orange yellow solid[34]	199-200[68]	v.p. at 130° = 0.0027 mm[34]	s. dioxane, ether, benzene[34]	dec. at 160°/ 0.0001 mm[34]		[34] JCS 609 (1951) [68] JACS 75 2446	uv spectra[34]
$(CF_3COCHCOMe)_2UO_2 \cdot 1/2EtOH$	yellow solid	205(dec.)	dec. when distilled	s. ethanol			[28] JACS 78 2790	
$(CF_3COCHCOt\text{-}Bu)_2UO_2$		134-136	nonvolatile at 130°				[68] JACS 75 2446	
$(CF_3COCHCOOEt)_2UO_2 \cdot H_2O$	yellow solid	125-127	dec. when distilled	s. ethanol			[28] JACS 78 2790	
$(Et_2NCS_2)_2UO_2 \cdot 4EtOH$	dark red crystals	dec.		s. hot ethanol			[47] JACS 79 4921	
	dark red crystals	>250		s. hot ethanol			[47] JACS 79 4921	

Compound	Color, Crystalline Form	m.p., °C	b.p., °C/mm	Solubility	Stability	Molecular Complexity	Reference	Remarks
$[(CH_2{=}CHCH_2)_2NCS_2]_2UO_2 \cdot 6EtOH$	dark red crystals	156		s. hot ethanol			[47] JACS 79 4921	
$(n\text{-}Pr_2NCS_2)_2UO_2 \cdot 6EtOH$	dark red crystals	186		s. hot ethanol			[47] JACS 79 4921	
$(n\text{-}Bu_2NCS_2)_2UO_2 \cdot 6EtOH$	dark red crystals	154		s. hot ethanol			[47] JACS 79 4921	
$(i\text{-}Bu_2NCS_2)_2UO_2 \cdot 6EtOH$	dark red crystals	188		s. hot ethanol			[47] JACS 79 4921	
$(s\text{-}Bu_2NCS_2)_2UO_2 \cdot 6EtOH$	dark red crystals	194		s. hot ethanol			[47] JACS 79 4921	
Plutonium(IV)								
$(i\text{-}PrO)_4Pu \cdot i\text{-}PrOH$	emerald-green solid		sublimes, 220/0.05	s. isopropyl alcohol	stable in dry air; dec. by water		[11] JCS 3318 (1957)	
$(t\text{-}BuO)_4Pu$	pale green solid		sublimes, 112/0.05		stable in dry air; dec. by water		[11] JCS 3318 (1957)	
$(Et_3CO)_4Pu$			sublimes, 150/0.05		stable in dry air; dec. by water		[11] JCS 3318 (1957)	
$(MeCOCHCOMe)_4Pu$	reddish-brown crystalline solid[69]	170-173 (slight dec.)	sublimes, 170/0.00001; v.p. = 4 ±1 x 10^{-4} mm at 140°[69]	s. $CHCl_3$, benzene[69]			[69] The Transuranium Elements, I, 855, (1949) [71] LA 1439	optical and crystal data[71]

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