

THIRD SUPPLEMENT

3

Dictionary of Organometallic Compounds

CHAPMAN AND HALL

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New Compounds for the Dictionary

The Editor is always pleased to receive comments on the selection policy and in particular welcomes specific suggestions for compounds or groups of compounds to be considered for inclusion in the Supplements.

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Third Supplement

Introduction

For detailed information about how to use the *Dictionary* see the Introduction in Volume 1 of the Main Work.

1. Using the Supplement

As in the Main Work volumes, every Entry is numbered to assist ready location. The Entry Number consists of a metal element symbol followed by a five-digit number. In this third Supplement the first digit is invariably **3**. Cross-references within the text to Entries having numbers beginning with zero refer to Main Work Entries.

Where a Supplement Entry contains additional or corrected information referring to an Entry in the Main Work, the whole Entry is reprinted, with the accompanying statement 'Updated Entry replacing . . .'. In such cases, the new Entry contains all of the information which appeared in the corresponding Main Work Entry, except for any which has been deliberately deleted. There should therefore be no necessity for the reader to consult the Main Work.

Chemical Names

Names reported in Chemical Abstracts since 1981 are labelled with the suffix 11CI. It is possible however that some further changes may take place before the publication of the 11th Collective Index covering the period 1982–86.

2. Literature Coverage

In compiling this Supplement the primary literature has been surveyed to mid 1986 and a considerable amount of information from later literature has also been included. In accordance with our policy of continually enhancing the usefulness of the *Dictionary*, a number of other compounds have been added for the first time. Some of these were suggested by users, to whom we are grateful.

3. Sources of Further Information

The following selected references to recent books and review articles provide more information about various aspects of organometallic chemistry. Together with references given in the Introduction to the Main Work and the First Supplement, they cover the literature up to mid 1986.

General

- Benn, R. *et al*, *Agnew. Chem. Int. Ed. Engl.*, 1986, **25**, 861 (*high resolution nmr of organometallics*)
Deacon, G.B. *et al*, *Adv. Organomet. Chem.*, 1986, **25**, 237 (*synthesis of organometallics by decarboxylation reactions*)
Lemenovskii, D.A. *et al*, *Russ. Chem. Rev.*, 1986, **55**, 127 (*dinuclear metallocenes*)
Lukehart, C.M., *Adv. Organomet. Chem.*, 1986, **25**, 45 (*metalla-derivatives of β -diketones*)
Stereochemistry of Organometallic and Inorganic Compounds, Bernal, I. Ed., 1986, **1**.
Suslick, K.S., *Adv. Organomet. Chem.*, 1986, **25**, 73 (*organometallic sonochemistry*)
Brookhart, M. *et al*, *Chem. Rev.*, 1987, **87**, 411 (*cyclopropanes from reactions of transition metal complexes with olefins*)
Chisholm, M.A. *et al*, *Polyhedron*, 1987, **6**, 665 (*recent advances in the chemistry of metal-metal multiple bonds*)
O'Connor, J.M. *et al*, *Chem. Rev.*, 1987, **87**, 307 (*ring slippage chemistry of transition metal cyclopentadienyl and indenyl complexes*)
Organometallic Chemistry (SPR), 1987, **15**.

Cluster Compounds

- Adams, R.D. *et al*, *Progr. Inorg. Chem.*, 1985, **33**, 127 (*novel reactions of metal carbonyl cluster compounds*)
Albers, M.O. *et al*, *Coord. Chem. Rev.* 1986, **69**, 127 (*cluster complexes containing opened transition metal polyhedra*)
Braunstein, P., *Nouv. J. Chim.*, 1986, **10**, 365 (*organometallic cluster compounds*)
Metal Clusters in Catalysis, Gates, B.C. *et al*, Eds, Elsevier, 1986.

Al Aluminum, Ga Gallium, In Indium and Tl Thallium

- Barron, A.R. *et al*, *Polyhedron*, 1986, **6**, 1897 (*transition metal alumino hydride complexes*)
Benn, R. *et al*, *Agnew. Chem. Int. Ed. Engl.*, 1986, **25**, 861 (*^{27}Al nmr spectroscopy*)
Harrison, P.G., *Coord. Chem. Rev.*, 1986, **75**, 128 (*elements of group III*)
Harrison, P.G., *Organometallic Chemistry (SPR)*, 1986, **14**, 59 (*Al, Ga, In, Tl, review of the literature covering 1984*)

Gmelin Handbook of Inorg. Chem., 8th Edn, 1987,
System no. 36 (organogallium compounds part I)

As Arsenic, Bi Bismuth and Sb Antimony

Arbuzov, B.A. *et al*, *Phosphorus Sulfur*, 1986,
26, 203 (cycloadditions to compounds with $\lambda^3\delta^2$ -
phosphorus and $\lambda^3\delta^2$ -arsenic multiple bonds)

Dove, M.F.A. *et al*, *Coord. Chem. Rev.*, 1986, **75**,
297 (a review of the literature for the year 1984)

Wardell, J.L., *Organometallic Chemistry (SPR)*,
1986, **14**, 141 (As, Sb, Bi, review of the literature
covering 1984)

Doak, G.O. *et al*, *J. Organomet. Chem.*, 1987, **324**,
39 (bismuth: annual survey covering the year 1985)

Freedman, L.D. *et al*, *J. Organomet. Chem.*, 1987,
324, 1 (antimony: annual review covering the year
1985)

Wardell, J.L., *Organometallic Chemistry (SPR)*,
1987, **15**, 138 (As, Sb, Bi, review of the literature
covering 1985)

Au Gold

Melník, M., *Coord. Chem. Rev.*, 1986, **70**, 157
(classification and analysis of gold compounds
on the basis of X-ray structural and Mössbauer
spectroscopic data)

Usón, R. *et al*, *Coord. Chem. Rev.*, 1986, **70**, 1 (recent
developments in arylgold chemistry)

Wardell, J.L., *Organometallic Chemistry (SPR)*,
1987, **15**, 1 (group I: the alkali and coinage metals,
a review of the literature covering 1985)

B Boron

Brown, H.C. *et al*, *Modern Synthetic Methods*,
Sheffold, R. Ed., Springer-Verlag, 1986, **4**, 307
(enantiomerically pure compounds via chiral
organoboranes)

Herberich, G.E. *et al*, *Adv. Organomet. Chem.*,
1986, **25**, 199 (borabenzene metal complexes)

Kabalka, G.W., *J. Organomet. Chem.*, 1987, **318**, 1
(boranes in organic synthesis: annual survey
covering the year 1984)

Spalling, T.R., *Organometallic Chemistry (SPR)*,
1987, **15**, 39 (carboranes and their metal derivatives,
review of the literature covering 1985)

Wilson, J.W., *Organometallic Chemistry (SPR)*,
1987, **15**, 24 (boron except carboranes, review of
the literature covering 1985)

Houben-Weyl, 4th Edn. Vol XIII, 3a–3c (organo-
boron: syntheses, reactions, analyses, structures)

Co Cobalt

Hay, R.W., *Coord. Chem. Rev.*, 1986, **71**, 37 (annual
review covering the year 1982)

Mague, J.T., *J. Organomet. Chem.*, 1987, **324**, 57
(cobalt, rhodium and iridium: annual survey cover-
ing the year 1985)

Cr Chromium, Mo Molybdenum and W Tungsten

Minelli, M. *et al*, *Coord. Chem. Rev.*, 1985, **68**, 169
(the nmr properties of compounds of chromium,
molybdenum and tungsten)

Cu Copper

Gmelin Handbook of Inorg. Chem., 8th Edn, 1985
(Organo-copper compounds Part I)

Fe Iron

Koridze, A.A., *Russ. Chem. Rev.*, 1986, **55**, 113
(ferrocenyl carbonium ions and related cationic
complexes)

Nametkin, N.S. *et al*, *Russ. Chem. Rev.*, 1986, **55**,
439 (chalcogen iron carbonyl clusters)

Kerber, R.C., *J. Organomet. Chem.*, 1987, **318**, 157
(organoiron chemistry: annual survey covering the
year 1985)

Rockett, B.W. *et al*, *J. Organomet. Chem.*, 1987, **318**,
231 (ferrocene: annual survey covering the year
1985)

Hf Hafnium

Sikora, D.J. *et al*, *Adv. Organomet. Chem.*, 1986, **25**,
318 (carbonyl derivatives of titanium, zirconium
and hafnium)

Holloway, C.E. *et al*, *J. Organomet. Chem.*, 1987,
321, 143 (zirconium and hafnium compounds:
analysis and classification of crystallographic and
structural data)

Hg Mercury

Larock, R.C., *Organomercury Compounds in
Organic Synthesis*, Springer-Verlag, Heidelberg,
1985.

Larock, R.C., *Solvomercuration/Demercuration
Reactions in Organic Synthesis*, Springer-Verlag,
Heidelberg, 1986.

Ir Iridium

Constable, E.C., *Coord. Chem. Rev.*, 1986, **73**, 113
(annual review covering the year 1983)

Gallop, M.A. *et al*, *Adv. Organomet. Chem.*, 1986,
25, 121 (carbene and carbyne complexes of
ruthenium, osmium and iridium)

Mague, J.T., *J. Organomet. Chem.*, 1987, **324**, 57 (cobalt, rhodium and iridium: annual survey covering the year 1985)

La Lanthanides

Dechter, J.J., *Progr. Inorg. Chem.*, 1985, **33**, 393 (nmr of scandium and the rare earths)

Mn Manganese, Tc Technetium, Re Rhenium

Herrmann, W.A., *et al*, *Polyhedron*, 1987, **6**, 1165 (organometallic oxides: the example of trioxo-(pentamethylcyclopentadienyl)rhenium)

Treichel, P.M., *J. Organomet. Chem.*, 1987, **318**, 83 (manganese, technetium and rhenium: annual survey covering the year 1984)

Treichel, P.M., *J. Organomet. Chem.*, 1987, **318**, 121 (manganese, technetium and rhenium: annual survey covering the year 1985)

Pb Lead

Wolters, J. *et al*, *Organomet. Chem.*, 1986, **313**, 413 (lead: annual survey covering the year 1984)

Armitage, D.A., *Organometallic Chemistry (SPR)*, 1987, **15**, 84 (the silicon group: review of the literature covering 1985)

Pd Palladium

Stille, J.K., *Agnew. Chem. Int. Ed. Engl.*, 1986, **25**, 508 (palladium catalysed cross-coupling reactions of R_3SnX and $R'Y$)

Tsuiji, J., *Pure Appl. Chem.*, 1986, **58**, 869 (new synthetic reactions catalysed by palladium complexes)

Tsuiji, J., *Tetrahedron*, 1986, **42**, 4361 (new general synthetic methods using allylpalladium compounds as intermediates)

Chaloner, P.A., *J. Organomet. Chem.*, 1987, **324**, 283 (nickel, palladium and platinum: annual survey covering the year 1980)

Pt Platinum

Chaloner, P.A., *J. Organomet. Chem.*, 1987, **324**, 283 (nickel, palladium and platinum: annual survey covering the year 1980)

Ru Ruthenium and Os Osmium

Gallop, M.A., *et al*, *Adv. Organomet. Chem.*, 1986, **25**, 121 (carbene and carbyne complexes of ruthenium, osmium and iridium)

Thomas, N.C., *Coord. Chem. Rev.*, 1986, **70**, 121 (substituted ruthenium carbonyl halides)

Bruce, M.I., *Coord. Chem. Rev.*, 1987, **76**, 1 (some reactions of ruthenium cluster carbonyls in mild conditions)

Keister, J.B., *J. Organomet. Chem.*, 1987, **318**, 297 (ruthenium and osmium: annual survey covering the year 1983)

Shapley, P.A., *J. Organomet. Chem.*, 1987, **318**, 409 (ruthenium and osmium: annual survey covering the year 1984)

Si Silicon

Wright, P.V., *Ring-opening Polymerisation*, Ivin, K.J. and Saegusa, T. Eds, 1984, **2** (cyclic siloxanes) *Advances in Organosilicon Chemistry*, Voronkov, M.G. Ed., Mir, Moscow, 1985.

Ojima, I., *Asymmetric Synth.*, Morrison, J.D. Ed., 1985, **5**, 102 (asymmetric hydrosilylation and hydrocarbonylation)

Wiberg, N., *Adv. Organomet. Chem.*, 1985, **24**, 179 (silyl, germyl and stannyl derivatives of azenes, N_nH_n : Part II, derivatives of triazene, N_3H_3 , tetrazene, N_4H_4 , and pentazene, N_5H_5)

Abraham, M.H., *Topics in Phys. Organomet. Chem.* Gielen, M.F. Ed., 1986, **1** (kinetics and mechanism of electrophilic substitution at saturated carbon, non-transition metal compounds)

Armitage, D.A., *Organometallic Chemistry (SPR)*, 1987, **15**, 84 (the silicon group)

Bertrand, G. *et al*, *Acc. Chem. Res.*, 1986, **19**, 17 (photochemical and thermal rearrangement of heavier main-group element azides)

Brook, A.G., *et al*, *Adv. Organomet. Chem.*, 1986, **25**, 1 (silenes)

Corey, J.Y., *J. Organomet. Chem.*, 1986, **313**, 1 (silafunctional compounds, synthesis and reactivity: annual survey for the year 1984)

Deschler, U., *et al*, *Agnew. Chem. Int. Ed. Engl.*, 1986, **25**, 236 (3-chloropropyltrialkoxysilanes – key intermediates for the commercial production of organofunctionalized silanes and polysiloxanes)

Fritz, G. *et al*, *Carbosilanes: Synthesis and Reactions*, Springer-Verlag, Heidelberg, 1986.

Larson, G.L., *J. Organomet. Chem.*, 1986, **313**, 141 (the silicon-carbon bond: annual survey covering the year 1984)

Oppenstein, A. *et al*, *Rev. Chem. Intermed.*, 1986, **6**, 275 (ion molecule reactions in volatile silanes)

Pawlenko, S., *Organosilicon Chemistry*, de Gruyter, Berlin, 1986.

Vedjs, E., *et al*, *Chem. Rev.*, 1986, **86**, 941 (ylides by the desilylation of α -silyl onium salts)

Weidenbruch, M., *Comments Inorg. Chem.*, 1986, **5**, 247 (cyclotrisiloxanes and related compounds)

Sn Tin

Gmelin *Handbook of Inorg. Chem.*, 1986, System no. 46 (organotin compounds part 13)

Ti Titanium

Reetz, M.T., *Organotitanium Reagents in Organic Synthesis*, Springer-Verlag, Heidelberg, 1985.

Sikora, D.J. *et al*, *Adv. Organomet Chem.*, 1986, **25**, 318 (carbonyl derivatives of titanium, zirconium and hafnium)

Zn Zinc

Erdik, E., *Tetrahedron*, 1987, **43**, 2203 (use of activation methods for organozinc reagents)

Wardell, J.L., *Organometallic Chemistry (SPR)*, 1987, **15**, 14 (the alkaline earths and zinc and its congeners: a literature survey covering 1985)

Zr Zirconium

Sikora, D.J. *et al*, *Adv. Organomet. Chem.*, 1986, **25**, 318 (carbonyl derivatives of titanium, zirconium and hafnium)

Holloway, C.E., *et al*, *J. Organomet. Chem.*, 1987, **321**, 143 (zirconium and hafnium organometallic compounds: analysis and classification of crystallographic and structural data)

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Ag Silver

C₄AgF₃
(Trifluoromethyl)silver

Ag-30001

F₃CAg

M 176.874

Synth. at -80° from Ag and CF₃ cocondensed at -196°.
Stable at -80°. Dec. to AgF at -10°.

PMe₃ adduct: (Trifluoromethyl)(trimethyl phosphine)-silver.

C₄H₉AgF₃P M 252.952

White light-sensitive solid. Subl. *in vacuo*. ³¹P nmr δ
37.6 ppm (rel. H₃PO₄).

Guerra, M.A. *et al*, *J. Organomet. Chem.*, 1986, **307**, C58
(*synth, nmr, ms, deriv*)

C₂₆H₂₂AgClP₂
Chloro[vinylidenebis(diphenylphosphine)]silver

Ag-30003

[CH₂=C(PPh₂)₂AgCl]_n

M 539.728

Largely dimeric in CHCl₃. Air- and light-stable pale-yellow cryst. V. sol. CH₂Cl₂, CHCl₃. Mp 133°. Several related complexes also prepd.

Schmidbaur, H. *et al*, *Organometallics*, 1985, **4**, 1208 (*synth, ms, ir, pmr, cmr, P-31 nmr*)

C₁₀H₉AgFe
Ferrocenylsilver
See Fe-30012

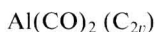
Ag-30002

Al Aluminum

C₂AlO₂

Aluminum carbonyl

Aluminum dicarbonyl. Dicarbonylaluminum
[12691-52-0]



M 83.002

Isol. in adamantane or Ar matrices: identified spectroscopically. Ir ν_{CO} 1985, 1903.8 cm⁻¹.

Hinchcliffe, A.J. *et al*, *J. Chem. Soc., Chem. Commun.*, 1972, 338 (*ir*)

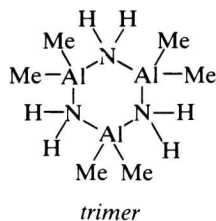
Kasai, P.H. *et al*, *J. Am. Chem. Soc.*, 1984, **106**, 8018 (*esr*)

Chenier, J.H.B. *et al*, *J. Chem. Soc., Chem. Commun.*, 1986, 730; *J. Phys. Chem.*, 1986, **90**, 1524 (*ir*, *esr*)

C₂H₈AlN

Amidodimethylaluminum

Aminodimethylalane. Dimethylaluminum amide
[24758-44-9]



M 73.073

Trimeric.

Trimer: [60363-54-4]. *Tri-μ-amidohexamethyltrialuminum*, 9Cl.

C₆H₂₄Al₃N₃ M 219.220

Colourless air-sensitive cryst. (heptane). Mp 134°. Bp₁ 70° subl. Dec. >150° with evolution of methane.

U.S.P., 3 703 359, (1972); *CA*, **78**, 99973 (*synth*, *use*)

Interrante, L.V. *et al*, *Better Ceramics through Chemistry II, Materials Research Society* 73, Pittsburgh 1986, 359 (*synth*, *cryst struct*, *use*)

C₄H₉Al₂Cl₃

Trichloro-μ-1,2-ethanedilethylaluminum

[98351-23-6]



M 217.437

Yellow air- and moisture-sensitive oil. Composition determined by hydrolysis.

Martin, H. *et al*, *Z. Naturforsch., B*, 1985, **40**, 182 (*synth*)

C₄H₁₂Al[⊖]

Tetramethylaluminate(1-)

Updated Entry replacing Al-00083



M 87.120 (ion)

Li salt: [14281-94-8].

C₄H₁₂AlLi M 94.061

Al-30001

Colourless cryst. (C₆H₆/Et₂O). Sol. THF. Mp 260° dec. Forms complex with 1,2-dimethoxyethane.

Na salt: [16060-25-6].

C₄H₁₂AlNa M 110.110

Air- and moisture-sensitive colourless cryst. (toluene).

Mp 221-225° dec. Forms (1:1) complex with THF, Mp 124-6°.

K salt: [24968-41-0].

C₄H₁₂AlK M 126.219

Cryst. Mp 264° dec.

Rb salt: [24968-40-9].

C₄H₁₂AlRb M 172.588

Colourless plates.

Cs salt: [24968-39-6].

C₄H₁₂AlCs M 220.026

Cryst.

Li(TMEDA)₂ salt: [97416-59-6].

C₁₆H₄₄AlLiN₄ M 326.473

Air- and moisture-sensitive colourless solid (hexane/Et₂O). Mp 161-163°.

Zakharkin, L.I. *et al*, *Zh. Obshch. Khim.*, 1962, **32**, 689.

Mach, K., *J. Organomet. Chem.*, 1964, **2**, 410 (*ir*)

Williams, K.C. *et al*, *J. Am. Chem. Soc.*, 1966, **88**, 4134 (*pmr*, *nmr*)

Oliver, J.P. *et al*, *J. Am. Chem. Soc.*, 1967, **89**, 163 (*nmr*)

Wolfrum, R. *et al*, *J. Organomet. Chem.*, 1969, **18**, 27 (*struct*)

Ross, J.F. *et al*, *J. Organomet. Chem.*, 1970, **22**, 503 (*pmr*)

Yamamoto, J. *et al*, *Inorg. Chem.*, 1971, **10**, 1129 (*ir*)

Atwood, J.L. *et al*, *J. Organomet. Chem.*, 1973, **61**, 43 (*struct*)

Weibel, A.T., *J. Organomet. Chem.*, 1974, **74**, 155 (*nmr*)

Yamamoto, O., *Chem. Lett.*, 1975, 511 (*nmr*)

Gavrilenko, V.V. *et al*, *Izv. Akad. Nauk SSSR, Ser. Khim.*, 1982, **31**, 2367 (*Al-27 nmr*)

Goel, A.B. *et al*, *Inorg. Chim. Acta*, 1984, **87**, 61 (*ir*)

Karsch, H.H. *et al*, *Organometallics*, 1985, **4**, 1624 (*deriv*)

Medley, J.H. *et al*, *J. Cryst. Spectrosc. Res.*, 1985, **15**, 99 (*cryst struct*)

C₆H₁₃Al₃Cl₄

Tetrachlorodi-μ-1,2-ethanedilethyltrialuminum

[98351-24-7]



M 307.925

White air- and moisture-sensitive powder. Spar. sol. pentane.

Martin, H. *et al*, *Z. Naturforsch., B*, 1985, **40**, 182.

C₆H₁₅Al

Triethylaluminum

Updated Entry replacing Al-10009

Aluminum triethyl. Triethylalane

As Trimethylaluminum, Al-30008 with

R = Et

M 114.166

Dimeric. Colourless liq. Air- and moisture-sensitive.

▷ Reacts violently with H₂O or alcohols. Pyrophoric.

Highly toxic. BD2050000.

Dimer: Hexaethyldialuminum.

Al-30004

Al-30006

C₁₂H₃₀Al₂ M 228.332Liq. d₂₅ 0.832. Mp –46° (–52.5°). Bp 194°, Bp₁₃ 100°.

Tetramethylhydrazine complex:

C₁₀H₂₇AlN₂ M 202.318Colourless liq. Bp_{0.4} 78°.

MeCN complex: [18307-84-1]. Colourless liq., air- and moisture-sensitive. Mp –6°. At 120° gives Dimethyl[(1-methylpropylidene)amino]aluminum, Al-10007.

Monoglyme complex (2:1):

C₁₆H₄₀Al₂O₂ M 318.454

Air- and moisture-sensitive colourless liq.

Diglyme complex (2:1):

C₁₈H₄₄Al₂O₃ M 362.507

Air- and moisture-sensitive colourless liq.

Triglyme complex (3:1):

C₂₆H₆₃Al₃O₄ M 520.726

Air- and moisture-sensitive colourless liq.

TMEDA complex: [15627-32-4].

C₁₈H₄₆Al₂N₂ M 344.538

Air- and moisture-sensitive colourless cryst. Mp 55°.

Bp₃ 176-179° subl. Monomeric.

Tetraethylenediamine complex: [15614-59-2].

C₂₂H₅₄Al₂N₂ M 400.645

Air- and moisture-sensitive colourless cryst. Mp 70°.

Bp₃ 150° subl. Monomeric.

Bipyridyl complex: [15614-60-5].

C₁₆H₂₃AlN₂ M 270.353Air- and moisture-sensitive orange-red cryst. (Et₂O).

Mp 115° dec. Monomeric.

Bis(diphenylphosphino)methane complex (2:1):

Bis(diphenylphosphino)methane-

bis(triethylaluminum).

C₃₇H₅₂Al₂P₂ M 612.728

Air-sensitive colourless solid (hexane). Mp 54°.

Dibenzo-18-crown-6 salt with 1.5 1-methylnaphthalene:

Air-sensitive colourless cryst.

Pajaro, G., *Ann. Chim. (Rome)*, 1958, **48**, 193 (*synth*)Hoffmann, E.G., *Z. Elektrochem.*, 1960, **64**, 616 (*ir, raman*)Ziegler, K. et al, *Justus Liebigs Ann. Chem.*, 1960, **629**, 1(*synth*)Jennings, J.R. et al, *J. Chem. Soc.*, 1965, 5083 (*synth, ir, pmr, deriv*)Starowieyski, K. et al, *Roczniki Chem.*, 1966, **40**, 47; *CA*, **65**, 3704 (*ir, deriv*)Ramey, K. et al, *J. Phys. Chem.*, 1965, **69**, 3418 (*pmr*)Nesmeyanov, A.N. et al, *The Organic Compounds of Boron, Aluminum, Gallium, Indium and Thallium*, 1967, North-Holland, Amsterdam (*rev*)Thiele, K-H. et al, *Z. Anorg. Allg. Chem.*, 1967, **349**, 33 (*derivs*)Chambers, D.B. et al, *J. Chem. Soc. (A)*, 1969, 1712 (*ms*)Dewar, M.J.S. et al, *J. Chem. Soc., Dalton Trans.*, 1973, 2381 (*nqr*)Kaminsky, W. et al, *Justus Liebigs Ann. Chem.*, 1975, 438 (*pmr*)Rottler, R. et al, *Z. Naturforsch., B*, 1976, **31**, 730 (*cmr*)Bochkarev, V.N. et al, *J. Gen. Chem. USSR*, 1979, **49**, 2019 (*ms*)Cocco, L. et al, *J. Org. Chem.*, 1979, **179**, 1 (*cmr*)Shuler, R.L. et al, *Inorg. Chim. Acta*, 1984, **85**, 185 (*pmr, derivs*)Schmidbaur, H. et al, *J. Organomet. Chem.*, 1985, **281**, 25 (*synth, nmr, cmr, P-31 nmr, deriv*)Bretherick, L., *Handbook of Reactive Chemical Hazards*, 2nd Ed., Butterworths, London and Boston, 1979, 606.Sax, N.I., *Dangerous Properties of Industrial Materials*, 6th Ed., Van Nostrand-Reinhold, 1984, 1050.C₆H₁₇AlP[⊖]

Al-30007

[(Dimethylphosphino)methyl]trimethylaluminum(1-)

Updated Entry replacing Al-10010

(Me₂PCH₂)AlMe₃[⊖]

M 147.156 (ion)

Li(TMEDA) salt: [97416-57-4].

C₁₅H₄₁AlLiN₃P M 328.405

Colourless cryst. Mp 141-142°.

Li(TMEDA)(THF) salt: [95099-94-8]. [μ-

[(Dimethylphosphino)methyl-C:P]](tetrahydrofuran)(N,N,N',N'-tetramethyl-1,2-ethanediamine-N,N')trimethylaluminumlithium.

C₁₆H₄₁AlLiN₃OP M 342.409

Colourless cryst. (THF/hexane). Mp 63-65°. Loses

THF in vacuum to give (TMEDA)Li(Me₂PCH₂)-AlMe₃ having Mp 65-70°.Karsch, H.H. et al, *Organometallics*, 1985, **4**, 1624 (*synth, cryst struct, pmr, P-31 nmr, ir*)C₃H₉Al

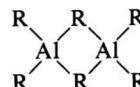
Al-30008

Trimethylaluminum, 9CI

Updated Entry replacing Al-10001

Aluminum trimethyl. Trimethylalane

[75-24-1]



R = Me

M 144.171

Dimeric at 70°.

► Causes burns. Explodes with H₂O. Pyrophoric. BD2204000.

Dimer: Di-μ-methyltetramethyldialuminum.

Hexamethyldialuminum.

C₆H₁₈Al₂ M 144.171

Methylating agent for tertiary alcohols, ketones, etc.

Liq. d₂₀ 0.752. Mp 15.4°. Bp 130°, Bp₈ 20°.Me₂NCH₂NMe₂ complex (2:1): [30471-01-3]. Hexamethyl[μ-(N,N,N',N'-tetramethylmethanediamine)]-dialuminum.C₁₁H₃₂Al₂N₂ M 246.350

White solid. Mp 103-106°.

TMEDA complex (2:1): [30471-04-6]. Hexamethyl[μ-(N,N,N',N'-tetramethylethylenediamine)]-dialuminum.

C₁₂H₃₄Al₂N₂ M 260.377

White solid. Mp 136-139°.

Me₂N(CH₂)₃NMe₂ complex (2:1): [30471-06-8]. Hexamethyl[μ-(N,N,N',N'-tetramethyl-1,3-propanediamine)]dialuminum.C₁₃H₃₆Al₂N₂ M 274.404

White solid. Mp 166-169°.

Diglyme complex (2:1): [16103-63-2]. [μ-[Bis(2-methoxyethyl)ether]]hexamethyldialuminum. (2,2'-Dimethoxydiethyl ether)bis(trimethylaluminum). Mp 3-5°. Bp_{0.001} 83-85°.

N-Methylmorpholine complex (2:1): Hexamethyl[μ-(4-methylmorpholine)]dialuminum.

C₁₁H₂₉Al₂NO M 245.319Colourless cryst. Mp 67-69°. Bp₄ 123-125°.

N-Methylmorpholine complex: [14878-33-2]. Trimethyl(4-methylmorpholine)aluminum.

C₈H₂₀AlNO M 173.234

Needles or plates (hexane). Mp 50-51°.

N,N'-Dimethylpiperazine complex (2:1): [14878-34-3].
[μ -(1,4-Dimethylpiperazine)]hexamethyldialuminum.
C₁₂H₃₂Al₂N₂ M 258.361
Cryst. (hexane). Mp 200-201°. Bp₃ 140-145°.

N,N'-Dimethylpiperazine complex: [14878-35-4]. (1,4-Dimethylpiperazine)trimethylaluminum.
C₉H₂₃AlN₂ M 186.276
Cryst. (hexane). Mp 62-63°.

Formaldehyde complex: [82495-17-8].
C₄H₁₁AlO M 102.112
Reacts with alkenes to give allylic alcohols and with enol ethers to give threo-1,3-diols. Formed and used *in situ* in CH₂Cl₂ (heptane).

4-Methylpyridine complex: [88008-81-5]. Trimethyl(4-methylpyridine)aluminum.
C₉H₁₆AlN M 165.214
White solid. Sol. C₆H₆. Mp 74.5-75.8°.

EtCN complex: [14647-11-1]. Trimethyl(propionitrile)-aluminum. (Ethyl cyanide)trimethylaluminum.
C₆H₁₄AlN M 127.165
Colourless solid; air- and moisture-sensitive. Mp 30°. Bp_{0.01} 70° subl.

Me₃CCN complex: (2,2-Dimethylpropanenitrile)-trimethylaluminum. (tert-Butyl cyanide)-trimethylaluminum.
C₈H₁₈AlN M 155.218
Colourless cryst. Sol. C₆H₆. Mp 61°. Bp_{0.01} 55-60° subl. Dec. on heating to Dimethyl[(1,2,2-trimethylpropylidene)amino]aluminum, Al-10016.

Hexamethyltetramine complex (1:2): see Hexamethyl[μ -(1,3,5,7-tetraazatricyclo[3.3.1.1^{3,7}]-decane-N¹:N³)]dialuminum, Al-10042

Hexamethylenetetramine complex (1:1): see Trimethyl(1,3,5,7-tetraazatricyclo[3.3.1.1^{3,7}]-decane-N¹)aluminum, Al-10026

Diphenylacetamide adduct: [41666-14-2]. (N,N-Diphenylacetamide-O)trimethylaluminum.
C₁₇H₂₂AlNO M 283.348
Air- and moisture-sensitive colourless solid. Mp 114°. Monomeric.

Diphenylbenzamide complex: [41655-38-3]. (N,N-Diphenylbenzamide-O)trimethylaluminum.
C₂₂H₂₄AlNO M 345.419
Air- and moisture-sensitive colourless solid. Mp 121-122°. Monomeric.

Bis(diphenylphosphino)methane complex: [96570-37-5]. Trimethyl[methylenebis(diphenylphosphine)]-aluminum. Bis(diphenylphosphino)methane trimethylaluminum.
C₂₈H₃₁AlP₂ M 456.482
Air-sensitive colourless cryst. (toluene/pentane). Mp 85°.

Monoglyme complex (2:1): Colourless liq. Characterized in cyclopentane by nmr.

Triglyme complex: Colourless solid.

MeCN complex: see Trimethylaluminum acetonitrile, Al-00115

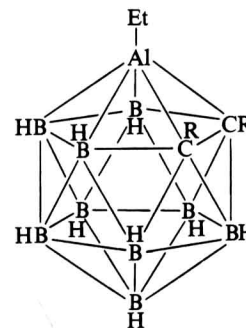
Bamford, C.H. *et al*, *J. Chem. Soc.*, 1946, 468 (synth)
Ziegler, K. *et al*, *Justus Liebigs Ann. Chem.*, 1954, **589**, 91 (synth)
Jennings, J.R. *et al*, *J. Chem. Soc.*, 1965, 5083 (derivs, synth, ir, pmr)
Ramey, K.C. *et al*, *J. Phys. Chem.*, 1965, **69**, 3418 (pmr)
Thiele, K.-H. *et al*, *Z. Anorg. Allg. Chem.*, 1966, **348**, 179.
Williams, K.C. *et al*, *J. Am. Chem. Soc.*, 1966, **88**, 5460 (pmr)
Lehmkuhl, H. *et al*, *Justus Liebigs Ann. Chem.*, 1967, **705**, 23 (deriv)
Ogawa, T., *Spectrochim. Acta, Part A*, 1968, **24**, 15 (ir, raman)
Chambers, D.B. *et al*, *J. Chem. Soc. (A)*, 1969, 1712 (ms)
Jeffery, E.A. *et al*, *Aust. J. Chem.*, 1969, **22**, 1120 (pmr)

Tanaka, J. *et al*, *Inorg. Chem.*, 1969, **8**, 265 (ms)
Pasykiewicz, S. *et al*, *J. Organomet. Chem.*, 1970, **25**, 29 (synth)
Huffman, J.C. *et al*, *J. Chem. Soc., Chem. Commun.*, 1971, 911 (cryst struct)
Yasuda, H. *et al*, *J. Organomet. Chem.*, 1973, **49**, 103; *Macromolecules*, 1973, **6**, 17 (derivs, synth, ir)
Bochkarev, V.N. *et al*, *J. Gen. Chem. USSR*, 1979, **49**, 2019; 1981, **51**, 1045 (ms)
Snider, B.B. *et al*, *J. Org. Chem.*, 1982, **47**, 3643; 1983, **48**, 2789 (use)
Dorogy, W.E. *et al*, *Inorg. Chim. Acta*, 1983, **73**, 31 (synth, pmr, cmr, Al-27 nmr, deriv)
Shuler, R.L. *et al*, *Inorg. Chim. Acta*, 1984, **85**, 185 (deriv, nmr)
Schmidbaur, H. *et al*, *J. Organomet. Chem.*, 1985, **281**, 25 (synth, nmr, cmr, P-31 nmr, complex)
Fieser, M. *et al*, *Reagents for Organic Synthesis*, Wiley, 1967-84, **8**, 506 (use)
Bretherick, L., *Handbook of Reactive Chemical Hazards*, 2nd Ed., Butterworths, London and Boston, 1979, 449.
Sax, N.I., *Dangerous Properties of Industrial Materials*, 6th Ed., Van Nostrand-Reinhold, 1984, 355.
Hazards in the Chemical Laboratory, (Bretherick, L., Ed.), 3rd Ed., Royal Society of Chemistry, London, 1981, 521.

C₆H₂₀AlB₉

Al-30009

Ethyl[(7,8,9,10,11- η)undecahydro-7,8-dimethyl-7,8-dicarbaundecaborato(2-)]aluminum
2,3-Dimethyl-1-ethyl-1,2,3-aluminadecaborane(9). 3-Ethyl-1,2-dimethyl-3-alumino-1,2-dicarba-closo-dodecaborane(12)

R = CH₃

M 216.496
Reagent for synthesis of metal carbollides. Colourless air- and moisture-sensitive solid. Mp 84-86°. Bp_{0.01} 70°.

Et₂O complex: 1-(Diethyl ether)-2,3-dimethyl-1-ethyl-1,2,3-aluminadecaborane(9).
C₁₀H₃₀AlB₉O M 290.618
Colourless air- and moisture-sensitive needles. Mp 330° dec.

THF complex: 2,3-Dimethyl-1-ethyl-1-tetrahydrofuran-1,2,3-aluminadecaborane(9).
C₁₀H₂₈AlB₉O M 288.602
Colourless air- and moisture-sensitive needles. Mp 308° dec.

Jutzi, P. *et al*, *J. Organomet. Chem.*, 1987, **319**, 139 (synth, pmr, cmr, B-11 nmr, Al-27 nmr)

C₇H₁₀Al₂Br₆

Al-30010

Tribromo[(deloc-2,3,4)-2,3,4-trimethyl-3-cyclobuten-2-ylum-1-yl]aluminum, 11Cl
[80206-75-3]

As μ -Bromopentabromo[(deloc-2,3,4)-2,4-dimethyl-3-cyclobuten-2-ylum-1-yl]dialuminum, Al-20016 with

R = CH₃

M 627.543

Reagent in synth. of pyridines, Dewar pyridones and (cyclobutadiene)iron complexes. Not isol.; prepd. in CH₂Cl₂ at –80° and used *in situ*.

Hogveen, H. *et al*, *Tetrahedron Lett.*, 1980, **21**, 659 (*synth*)

Hogveen, H. *et al*, *J. Org. Chem.*, 1982, **47**, 989, 997 (*synth*, *nmr*, *cmr*, *use*)

Fongers, K.S. *et al*, *Synthesis*, 1982, 839 (*use*)

C₇H₁₇AlO₂**Al-30011****Diethyl(2-methoxyethanolato-*O*¹)aluminum**

Diethylaluminum 2-methoxyethoxide

[102965-48-0]

As (2-Methoxyethanolato)dimethylaluminum, Al-20012 with

R¹ = Et, R² = Me

M 160.192

Dimeric.

*Dimer: Tetraethylbis[μ-(2-methoxyethanolato-*O*:*O*')]dialuminum.*

C₁₄H₃₄Al₂O₄ M 320.383

Colourless air- and moisture-sensitive liq.

Benn, R. *et al*, *Angew. Chem., Int. Ed. Engl.*, 1983, **22**, 779;

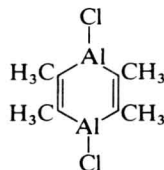
Organometallics, 1986, **5**, 825 (*synth*, Al-27 *nmr*)

C₈H₁₂Al₂Cl₂**Al-30012****Dichlorobis[μ-(1,2-dimethyl-1,2-ethenediyl)]dialuminum,**

11Cl

1,4-Dichloro-2,3,5,6-tetramethyl-1,4-dialumina-2,5-cyclohexadiene. Bis(μ-but-2-ene-2,3-diyl)-dichlorodialuminum

[104598-76-7]



M 233.052

Dimeric by formation of Al-alkene bonds.

Dimer: [104598-75-6]. Tetrachlorotetrakis[μ₃-[(1-η:1,2-η:2-η)-1,2-dimethyl-1,2-ethenediyl]]tetraaluminum, 11Cl.

C₁₆H₂₄Al₄Cl₄ M 466.104

Colourless air- and moisture-sensitive cryst. (pentane).

Schnöckel, H. *et al*, *Angew. Chem., Int. Ed. Engl.*, 1986, **25**, 921 (*synth*, *cryst struct*, *pmr*)

C₈H₁₅AlO**Al-30013****(2-Methyl-3-pentyn-2-oxy)dimethylaluminum**

*Dimethyl(1,1-dimethylbut-2-ynolato-*O*)aluminum*

Me₂AlOC(CH₃)₂C≡CCH₃

M 154.187

Dimeric in soln.

Dimer: Bis(2-methyl-3-pentyn-2-oxy)-tetramethyldialuminum.

C₁₆H₃₀Al₂O₂ M 308.375

Colourless air- and moisture-sensitive solid. Subl. 10⁻⁵ torr., at unspecified temp.

Starowieyski, K.B. *et al*, *J. Organomet. Chem.*, 1985, **293**, 7 (*synth*, *pmr*, *cmr*)

C₈H₂₀Al^o**Al-30014****Tetraethylaluminum(1–)**

Updated Entry replacing Al-20035

[14913-44-1]

Et₄Al^o

M 143.228 (ion)

Li salt: [2666-13-9].

C₈H₂₀AlLi M 150.169

Component catalyst for polymn. of caprolactam and piperidones. Needles (C₆H₆). Mp 163-165°. Bp_{0.001} 160°. Struct. of Li salt similar to that of Me₂Be.

Na salt: [2397-68-4].

C₈H₂₀AlNa M 166.217

White cryst. (C₆H₆/hexane). Mp 122-124°.

K salt: [7097-97-4].

C₈H₂₀AlK M 182.326

Component of catalysts for polymn. of caprolactam and piperidones. Colourless cryst. Mp 80-82° (74°).

Me₄N salt: [25776-17-4]. Colourless solid. Mp 162-165°.

Ethylmagnesium salt: see Ethylmagnesium tetraethylaluminate, Al-00367

Ca salt: [16070-59-0].

C₁₆H₄₀Al₂Ca M 326.535

Colourless cryst. (hexane). Several solvates isol.

Ca salt, bis(THF) solvate: [12247-57-3].

C₂₄H₅₆Al₂CaO₂ M 470.748

White air- and moisture-sensitive cryst. Mp 94-96°.

Solvate with 6THF, Mp 165-166° dec. also descr.

Ca salt, Bis(DME) solvate: [51320-40-2].

C₂₄H₆₀Al₂CaO₂ M 474.780

White air- and moisture-sensitive cryst. Mp 84-86°.

Liq. solvates with 4Et₂O and with 4NMe₃ also formed.

Ca salt, Bis(TMEDA) solvate: [56422-37-8].

C₂₈H₇₂Al₂CaN₄ M 558.947

White air- and moisture-sensitive solid. Mp 118-122° dec.

Sr salt, hexakis(THF) solvate: [56422-39-0].

C₄₀H₈₈Al₂O₆Sr M 806.715

White air- and moisture-sensitive solid. Mp 136-140°.

Frey, F.W. *et al*, *J. Org. Chem.*, 1961, **26**, 2950 (*synth*)

Dickson, R.S. *et al*, *Aust. J. Chem.*, 1962, **15**, 710.

Zakharkin, L.I. *et al*, *Zh. Obshch. Khim.*, 1962, **32**, 689.

Chuck, R.J. *et al*, *Nucl. Magn. Reson. Chem., Proc. Symp. Cagliari, Italy*, 1964, 189 (*nmr*)

Gerteis, R.L. *et al*, *Inorg. Chem.*, 1964, **3**, 872 (*struct*)

Lehmkuhl, H. *et al*, *Justus Liebig's Ann. Chem.*, 1967, **705**, 1, 42 (*synth*)

Gavrilenko, V.V. *et al*, *Izv. Akad. Nauk SSSR, Ser. Khim.*, 1969, 1380 (*synth*)

Lehmkuhl, H. *et al*, *Houben-Weyl Methoden Org. Chem.*, 4th Ed., 1970, **13/4**, 127.

Westmoreland, T.D., *J. Organomet. Chem.*, 1972, **38**, 1; *J. Am. Chem. Soc.*, 1973, **95**, 2019 (*pmr*, *cmr*)

Ivanov, L.L. *et al*, *Synth. React. Inorg. Metal.-Org. Chem.*, 1973, **3**, 327.

Ivanov, L.L. *et al*, *J. Gen. Chem. USSR (Engl. Transl.)*, 1975, **45**, 1046 (*synth*)

Gavrilenko, V.V. *et al*, *Izv. Akad. Nauk SSSR, Ser. Khim.*, 1982, **31**, 2367 (Al-27 *nmr*)

Medley, J.H. *et al*, *J. Cryst. Spectrosc. Res.*, 1985, **15**, 99 (*cryst struct*)

Having problems with locating a compound? Have you checked the indexes?

C₈H₂₀Al₂O**Tetraethyl-μ-oxodialuminum, 9Cl**

Updated Entry replacing Al-00283
Oxybis[diethylaluminum]
 [1069-83-6]



M 186.208

Associated in hydrocarbons and ethers. Trimeric in C₆H₆.
 Catalyst for stereospecific polymerisation of alkenes,
 dialkenes, oxirans.

Trimer: [61337-21-1]. *Tri-μ-ethylnonaethyltri-μ₃-oxo-hexaaluminum, 10Cl*.

C₂₄H₆₀Al₆O₃ M 558.625

Colourless air- and moisture-sensitive liq. Isol. by gel permeation chromatog. Slowly disproportionates to Et₃Al and Et₂Al(OAlEt)₂OAlEt₂.

Et₂O complex: [73768-21-5].

C₁₂H₃₀Al₂O₂ M 260.331

Viscous liq. Sol. hydrocarbons, Et₂O.

Me₃N complex:

C₁₁H₂₉Al₂NO M 245.319

Viscous liq. Apparently associated in C₆H₆.

Benzo[f]quinoline complex: [40961-82-8].

C₂₁H₂₉Al₂NO M 365.429

Pale-yellow needles (hexane). Mp 75°.

Storr, A. *et al*, *J. Am. Chem. Soc.*, 1968, **90**, 3173 (*synth, ir, pmr*)

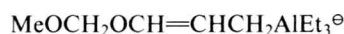
Sakharovskaya, G.B. *et al*, *J. Gen. Chem. USSR (Engl. Transl.)*, 1969, **39**, 749 (*synth, ir*)

Ueyama, N. *et al*, *Inorg. Chem.*, 1973, **12**, 2218 (*synth, pmr, ir*)

Ueyama, N. *et al*, *Macromolecules*, 1974, **7**, 153 (*use*)

Siegiejczyk, L. *et al*, *J. Organomet. Chem.*, 1986, **311**, 253 (*synth*)

Organomet. Synth., 1986, **3**, 472 (*synth, props*)

Al-30015**C₁₁H₂₄AlO₂[⊖]****[3-(Methoxymethoxy)-2-propenyl]triethylaluminate(1-)**

M 215.291 (ion)

Li salt:

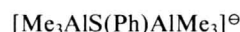
C₁₁H₂₄AlLiO₂ M 222.232

Reacts with aldehydes with high stereo- and regioselectivity. Not isol.; used in hexane/Et₂O.

Yamamoto, Y. *et al*, *J. Org. Chem.*, 1984, **49**, 1096 (*synth, use*)

Al-30018**C₁₂H₁₈Al₃Cl₁₂Sm****Al-30019****Hexa-μ-chlorotris(dichloroaluminum)(1,2,3,4,5,6-η)-****1,2,3,4,5,6-hexamethylbenzene[samarium, 11Cl**

See Sm-30002

C₁₂H₂₃Al₂S[⊖]**Al-30020****[μ-(Benzenethiolato-S:S)]hexamethyldialuminate(1-)****Hexamethyl-μ-(phenylthio)dialuminate(1-)**

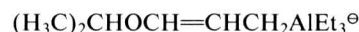
M 253.337 (ion)

Li salt: [99331-17-6].

C₁₂H₂₃Al₂LiS M 260.278

White powder. Spar. sol. hexane.

Weers, J.J. *et al*, *J. Organomet. Chem.*, 1985, **286**, 47 (*synth*)

C₁₂H₂₆AlO[⊖]**Al-30021****[3-Isopropoxy-2-propenyl]triethylaluminate(1-)**

M 213.318 (ion)

Li salt:

C₁₂H₂₆AlLi M 204.260

Reacts with aldehydes with high stereo- and regioselectivity. Not isol.; used in Et₂O/cyclohexane.

Yamamoto, Y. *et al*, *J. Org. Chem.*, 1984, **49**, 1096 (*synth, use*)

Yamamoto, Y. *et al*, *J. Organomet. Chem.*, 1985, **285**, 31 (*synth, use*)

Al-30016**C₁₀H₁₆AlNO****Diethyl(2-pyridinemethanolato)aluminum****Diethyl(2-pyridylmethoxy)aluminum**

As Chloroethyl(2-pyridinemethanolato)aluminum, Al-20029 with



M 193.224

Dimeric.

Dimer: [96999-32-5]. *Tetraethylbis[μ-(2-pyridinemethanolato-N':O''O''O'')]dialuminum, 11Cl*.

C₂₀H₃₂Al₂N₂O₂ M 386.448

White air- and moisture-sensitive cryst.

(CH₂Cl₂/hexane 1:4). Sol. C₆H₆, CH₂Cl₂, CHCl₃, Py.

van Vliet, M.R.P. *et al*, *Organometallics*, 1985, **4**, 1701 (*synth, pmr, cmr, Al-27 nmr*)

Benn, R. *et al*, *Organometallics*, 1986, **5**, 825 (*Al-27 nmr*)

Al-30017**C₁₁H₂₃Al****Dimethyl(2-methyl-1-octenyl)aluminum**

M 182.284

(*E*)-*form* [77958-37-3]

Reagent for synth. of allylarenes. Not. isol., used *in situ* (CICH₂CH₂Cl).

Negishi, E. *et al*, *Tetrahedron Lett.*, 1981, **22**, 2715 (*synth, use*)

C₁₂H₂₈Al₂O**Al-30022****Hydrotris(2-methylpropyl)-μ-oxodialuminum, 11Cl****Triisobutyl(hydrido)dialuminoxane**

[88477-39-8]



M 242.316

Trimeric in C₆H₆. Colourless viscous air- and moisture-sensitive liq.

Trimer:

C₃₆H₈₄Al₆O₃ M 726.947

Struct. unknown.

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