

<p>27-0485 & 27-0486</p>	<p>26-0145</p>	<p>28-0045</p>	<p>50-1170</p>
<p>57-1200</p>	<p>71-1050</p>	<p>70-1000</p>	<p>39-1550</p>
<p>12-0845</p>	<p>25-0230</p>	<p>29-7100</p>	<p>27-0468 and 27-0469</p>
<p>44-0056</p>	<p>21-1200</p>	<p>20-8200</p>	

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20-8200 Bis(N,N'-di-i-propylformamidinato)calcium(II) dimer, (99.99 %-Ca) PURATREM [1959584-78-1] 1g
 $C_{28}H_{60}Ca_2N_8$; FW: 588.99; tan to light-brown pwdr. 5g

Technical Notes:

1. Calcium amidinate precursor for the atomic layer deposition (ALD) of calcium containing thin films.

References:

1. *Angew.Chem. Int. Ed.*, **2016**, 55, 10228 –10233.

27-0485 Bis(N,N'-di-i-propylacetamidinato)cobalt (II), min. 98% [635680-58-9] 250mg
 $(C_8H_{17}N_2)_2Co$; FW: 341.40; green xtl 1g

Technical Notes:

1. Precursor with metal nitrogen bonds used for the atomic layer deposition of metals, nitrides and oxides. See WO 2004/046417A2.
2. Copper complex used in the vapor phase, atomic layer deposition of Co_9S_8 and its application for super conductors.
3. Complex used in the atomic layer deposition of cobalt sulfide.

References:

1. *Nano Letters*, **2015**, 15, 6689.
2. *ACS Nano*, **2015**, 9, 8484.

27-0486 Bis(N,N'-di-i-propylacetamidinato)cobalt (II), min. 98% (99.99%-Co) PURATREM Co(iPr-MeAMD)₂ 250mg
[635680-58-9] 1g
 $(C_8H_{17}N_2)_2Co$; FW: 341.40; green xtl

Technical Notes:

1. See 27-0485.

27-0468 Bis(N-t-butyl-N'-ethylpropanimidamidato)cobalt (II), min. 98% [1011477-51-2] 1g
 $C_{18}H_{38}CoN_4$; FW: 369.45; blue-green liq. 5g

Technical Notes:

1. Volatile cobalt complex for the atomic layer deposition of cobalt metal.

References:

1. *Chemistry of Materials*, **2014**, 26, 2642.
2. *J. Phys. Chem. Lett.*, **2014**, 5, 1091.
3. *Dalton, T.*, **2008**, 19, 2592.

27-0469 Bis(N-t-butyl-N'-ethylpropanimidamidato)cobalt (II), min. 98% (99.99%-Co) PURATREM 1g
[1011477-51-2] 5g
 $C_{18}H_{38}CoN_4$; FW: 369.45; blue-green liq.

Technical Notes:

1. See 27-0468

29-7100 Bis(N,N'-di-sec-butylacetamidinato)dicopper (I), 99% [695188-31-9] 250mg
 $(C_{10}H_{42}N_2)_2Cu_2$; FW: 465.67; white to off-white xtl. 1g

Technical Notes:

1. Precursor with metal nitrogen bonds used for the atomic layer deposition of metals, nitrides and oxides. See WO 2004/046417A2.

References:

1. *Chem. Mater.*, **2011**, 23, 4411.
2. *J. Am. Chem. Soc.*, **2009**, 131, 18159.
3. *Appl. Phys. Lett.*, **2009**, 94, 123107/1.
4. *Inorg. Chem.*, **2005**, 44, 1728.

26-0145 Bis(N,N'-di-t-butylacetamidinato)iron (II), min. 98% [635680-56-7] 250mg
 $C_{20}H_{42}N_4Fe$; FW: 394.42; off-white to gray xtl. 1g
5g

Technical Notes:

1. Iron amidinate used in the chemical vapor deposition of iron, iron carbides and iron nitride films.
2. Precursor for the MOCVD of iron-containing thin films.
3. Fabrication of thin films of iron oxide via atomic layer deposition.

References:

1. *Journal of Electrochemical Society*, **2010**, 157, D454.
2. *ECS Transactions*, **2009**, 25, 181.
3. *ACS Appl. Mater. Interfaces*, **2015**, 7, 16138.

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57-1200 Tris(N,N'-di-i-propylformamidinato)lanthanum(III), (99.999+%-La) PURATREM La-FMD 1g
[1034537-36-4] 5g
C₂₁H₄₅LaN₆; FW: 520.53; white to off-white powdr.

Technical Notes:

1. Lanthanum precursor for the ALD/CVD of La₂O₃, LaLuO₃, LaScO₃, and LaYO₃ thin films

References:

1. *Appl. Phys. Lett.*, **2009**, 94, 262904
2. *Electrochem. Solid-State Lett.*, **2009**, 12, G13
3. *Appl. Phys. Lett.*, **2010**, 97, 162910
4. *J. Electrochem. Soc.*, **2011**, 158, H447
5. *ECS Trans.*, **2012**, 45, 95
6. *Nano Lett.*, **2013**, 13, 594
7. *J. Crystal Growth*, **2013**, 363, 150
8. *ECS Trans.*, **2013**, 54, 255
9. *App. Surface Sci.*, **2014**, 292, 880
10. *Proc. SPIE*, **2014**, 8987, 898712

71-1050 Tris(N,N'-di-i-propylacetamidinato)lutetium (III), 99% 250mg
Lu(C₈H₁₇N₂)₃; FW: 598.67; white to off-white powdr. 1g

12-0845 Bis(N,N'-di-sec-butylacetamidinato)magnesium, 99% 1g
C₂₀H₄₂MgN₄; FW: 362.88; 5g

25-0230 Bis(N,N'-di-i-propylpentylamidinato)manganese (II), min. 98% [1188406-04-3] 250mg
C₂₂H₄₆MnN₄; FW: 421.57; brown solid 1g

Reference:

1. *J. Phys. Chem. C*, **2012**, 116, 23585.

28-0045 Bis(N,N'-di-t-butylacetamidinato)nickel (II), (99.999%-Ni) PURATREM [940895-79-4] 250mg
C₂₀H₄₂N₄Ni; FW: 397.27; dark, purple-black xtl. 1g
5g
25g

Technical Notes:

1. CVD/ALD precursor for the preparation of nickel nitride (NiNx) films.
2. CVD/ALD precursor for the preparation of nickel sulfide (NiSx) films co-deposited by H₂S

Reference:

1. *Chem. Mater.*, **2010**, 22, 3060.
2. *Chem. Mater.*, **2016**, 28, 1155.

44-0056 Bis(N,N'-di-tert-butylacetamidinato)ruthenium(II) dicarbonyl, 98% (99.99%-Ru) PURATREM 1g
C₂₂H₄₂N₄O₂Ru; FW: 495.67; beige to yellow solid 5g

Technical Notes:

1. Precursor used for the CVD and ALD of Ruthenium-containing thin films.

References:

1. Wang, Xinwei; Gordon, Roy G., *Crystal Growth & Design*, **2013**, 13(3), 1316-1321.
2. Wang, Qing Min; Shenai-Khatkhate, Deodatta Vinayak; Li, Huazhi, U.S. Pat. Appl. Publ. **2011**, US 20110064879 A1 20110317
3. Wang, Hongtao; Gordon, Roy G.; Alvis, Roger; Ulfig, Robert M., *Chemical Vapor Deposition*, **2009**, 15(10-11-12), 312-319
4. Li, Huazhi; Aaltonen, Titta; Li, Zhengwen; Lim, Booyong S.; Gordon, Roy G., *Open Inorganic Chemistry Journal*, **2008**, 2, 11-17.
5. Li, Huazhi; Farmer, Damon B.; Gordon, Roy G.; Lin, Youbo; Vlassak, Joost, *Journal of the Electrochemical Society*, **2007**, 154(12), D642-D647.
6. Farmer, Damon B.; Gordon, Roy G., *Journal of Applied Physics*, **2007**, 101(12), 124503/1-124503/5.
7. Li, H.; Framer, D. B.; Gordon, R. G.; Lin, Y.; Vlassak, J., *J. Electrochem. Soc.*, **2007**, 154, D642.

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21-1200 Tris(N,N'-di-i-propylformamidinato)scandium(III), (99.9%-Sc) 1g
 $C_{21}H_{45}ScN_6$; FW: 426.58; white to off-white powdr. 5g

Technical Note:

- Other similar Scandium amidinates have been used for the vapor deposition (ALD) of Sc_2O_3 films.

References:

- Philippe de Rouffignac, Andrew P. Yousef, Kyoung H. Kim, and Roy G. Gordon, *Electrochemical and Solid-State Letters*, **2006**, 9 (6), F45-F48.
- Kyoung H. Kim, Damon B. Farmer, Jean-Sebastien M. Lehn, P. Venkateswara Rao and Roy G. Gordon, *Applied Physics Letters*, **2006**, 89, 133512
- Hongtao Wang, Jun-Jieh Wang, Roy Gordon, Jean-Sébastien M. Lehn, Huazhi Li, Daewon Hong and Deo V. Shenai, *Electrochemical and Solid-State Letters*, **2009**, 12 (4), G13-G15.
- Xinwei Wang, Omair I. Saadat, Bin Xi, Xiabing Lou, Richard J. Molnar, Tomas Palacios and Roy G. Gordon., *Applied Physics Letters*, **2012**, 101, 232109

50-1170 Bis(N,N'-di-i-propylacetamidinato)tin (II), 99% [1421599-46-3] 250mg
 $Sn(C_8H_{17}N_2)_2$; FW: 401.18; white xtls. 1g

Reference:

- Chem. Mater.*, **2014**, 26, 3065.
- Adv. Eng. Mater.*, **2011**, 1, 1116.

70-1000 Tris(N,N'-di-i-propylacetamidinato)ytterbium (III), 99% 250mg
 $Yb(C_8H_{17}N_2)_3$; FW: 596.74; white to off-white powdr. 1g

39-1550 Tris(N,N'-di-i-propylformamidinato)yttrium (III), 97% 250mg
 $C_{21}H_{45}N_6Y$; FW: 470.53; light beige-yellow solid 1g
 5g

Additional Product Details

Metal amidinate complexes, with intriguing structural diversity and novel properties, have been the subject of intense investigations in chemistry, electronics, optics, energy, and materials science.^[1-4] Great interest has been focused on the applicability of the complexes as single-source precursors of advanced functional materials.^[5] Metal-based amidinate complexes have been used as volatile precursors for Atomic Layer Deposition of films with novel versatile properties. This allows a wide variety of applications in modern high technology, including semiconductor micro-electronics, high-resolution displays, optical filters, magnetic information storage, and catalysis.^[10-12] The precursors need to be designed in such a way that the compounds are volatile and thermally stable at growth temperatures.^[10,13] Generally, more volatility directly correlates with a better precursor. The synthesis and characterization of numerous metal compounds with amidinate ligands have been reported in the literature.^[10,12-14] The volatility and thermal stability of symmetric amidinates of transition metals and lanthanum with oxidation states of one (Cu, Ag, Au),^[15] two (Mg, Mn, Fe, Co, Ni),^[16] three (Ti, V, Y, Al, Ga, La),^[17] and four (Ru, Hf)^[8] have been reported.

References

- A. R. Sadique, M. J. Heeg, C. H. Winter, *J. Am. Chem. Soc.* **2003**, 125, 7774-7775.
- J. R. Hagadorn, J. Arnold, *Angew. Chem. Int. Ed.* **1998**, 37,1729-1731; *Angew. Chem.* **1998**, 110, 1813-1815.
- H. Kondo, K. Matsubara, H. Nagashima, *J. Am. Chem. Soc.* **2002**, 124, 534-535.
- X. Jiang, J. C. Bollinger, M. H. Baik, D. Lee, *Chem. Commun.* **2005**, 8, 1043-1045.
- J. Barker, N. C. Blacker, P. R. Phillips, N. W. Alcock, W. Errington, M. G. H. Wallbridge, *J. Chem. Soc., Dalton Trans.* **1996**, 431-437.
- D. Abeysekera, K. N. Robertson, T. S. Cameron, J. A. C. Clyburne, *Organometallics* **2001**, 20, 5532-5536.
- C. Villiers, P. Thuery, M. Ephritikhine, *Eur. J. Inorg. Chem.* **2004**, 23, 4624-4632.
- D. A. Kissounko, Y. H. Zhang, M. B. Harney, L. R. Sita, *Adv. Synth. Catal.* **2005**, 347, 426-432.
- T. Chivers, C. Fedorchuk, M. Parvez, *Organometallics* **2005**, 24, 580-586.
- B. S. Lim, A. Rahtu, J.-S. Park, R. G. Gordon, *Inorg. Chem.* **2003**, 42, 7951-7958.
- a) D. Hausmann, J. Becker, S. Wang, R. G. Gordon, *Science* **2002**, 298, 402-406
 b) B. S. Lim, A. Rahtu, R. G. Gordon, *Nat. Mater.* **2003**, 2, 749-754
 c) R. G. Gordon, S. Barry, R. N. R. Broomhall-Dillard, D. J. Teff, *Adv. Mater. Optics Electron.* **2000**, 10, 201-211.
- A. I. Kingon, J. P. Maria, S. K. Streiffer, *Nature* **2000**, 406, 1032-1038.
- Z. Li, S. T. Barry, R. G. Gordon, *Inorg. Chem.* **2005**, 44, 1728-1735.
- F. T. Edelmann, D. M. M. Freckmann, H. Schumann, *Chem. Rev.* **2002**, 102, 1851-1896.
- H. E. Abdou, A. A. Mohamed, J. M. Lopez-de-Luzuriaga, J. P. Fackler, *J. Cluster Sci.* **2004**, 15, 397-411.
- a) R. T. Boere, M. L. Cole, P. C. Junk, *New J. Chem.* **2005**, 29, 128-134;
 b) F. A. Cotton, N. S. Dalal, C. Y. Liu, C. A. Murillo, J. M. North, X. P. Wang, *J. Am. Chem. Soc.* **2003**, 125, 12945-12952.
- a) M. J. McNevin, J. R. Hagadorn, *Inorg. Chem.* **2004**, 43, 8547-8554
 b) P. de Rouffignac, J. S. Park, R. G. Gordon, *Chem. Mater.* **2005**, 17, 4808-4814
 c) W. X. Zhang, M. Nishiura, Z. M. Hou, *J. Am. Chem. Soc.* **2005**, 127, 16788-16789
 d) M. L. Cole, C. Jones, P. C. Junk, M. Kloth, A. Stasch, *Chem. Eur. J.* **2005**, 11, 4482-4491.

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