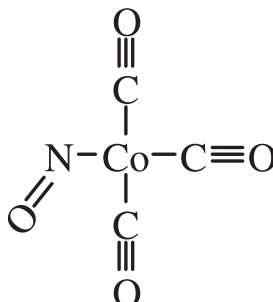


INCO032

COBALT TRICARBONYL NITROSYL



Molecular Formula
CAS#

C₃CoNO₄
14096-82-3

M.W.:	172.97	MP °C:	-1.1°
BP °C/mm Hg:	50°	Vapor Pressure, 20°:	100 mm
Specify Gravity:	1.47	Ionization Energy:	8.3 eV

Cobalt Tricarbonyl Nitrosyl presents clear advantages versus other available precursors in CVD deposition processes. Cobalt Tricarbonyl Nitrosyl is a liquid, in contrast to most Co precursors which are solids. Further, thermal decomposition of Cobalt Carbonyl [Co₂(CO)₈] introduces undesirable reaction products (polymerization products together with HCo(CO)₄ arising from H₂ available in the chamber), and is not very stable under normal storage conditions. Other precursors for Co CVD include Cobaltocene [Co(C₅H₅)₂], Cyclopentadienylcobalt Dicarbonyl [C₅H₅Co(CO)₂], and Cobalt Acetylacetonate [Co(C₅H₇O₂)₃]: all these sources require H₂ reduction and under atmospheric pressure CVD (APCVD) yield Co films with an unacceptably rough surface morphology.

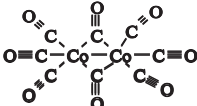
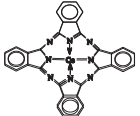

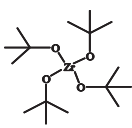
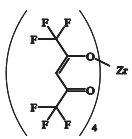
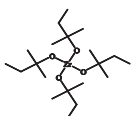
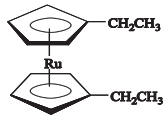
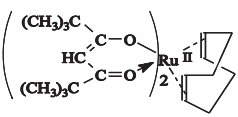
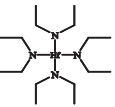
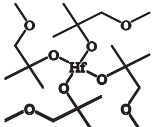

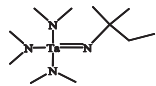
Cobalt Tricarbonyl Nitrosyl has high volatility (vapor pressure 26 Torr at 0°C and 100 Torr at 25°C), is available in liquid form, and exhibits good stability (decomposition temperature >66°C) and low toxicity. Furthermore, Co is in an oxidation state of zero in this compound, which implies that metal-ligand bonds are easily cleaved to yield pure metal films, and only CO + NO as byproducts.

Applications:

- ❖ **Deposition of cobalt for magnetic thin films¹.**
- ❖ **In combination with Fe(CO)₅ forms spherical Fe/Co particles².**
- ❖ **Low Temperature CVD methodology of epitaxial CoSi₂ growth^{4, 6}.**
- ❖ **Employed in CVD of cobalt and epitaxy formation of cobalt silicide³.**
- ❖ **Optimize processing Co epitaxy growth in integrated silicide circuits⁵.**
- ❖ **Forming electrical contacts on transistor source/drain and gate regions⁷.**

The growth of thin films via chemical vapor deposition (CVD) is an industrially significant process with a wide array of applications, notably in microelectronic device fabrication. Chemical vapor deposition (CVD) is carried out by passing a volatilized precursor (such as a silane, organometallic or metal coordination complex) over a heated substrate. Thermal decomposition of the precursor produces a thin-film deposit, and ideally, the ligands associated with the precursor are cleanly lost to the gas phase as reaction products. Compared to other thin-film production techniques, CVD offers several significant advantages, most notably the potential for effecting selective deposition and lower processing temperatures. Many metal CVD depositions are autocatalytic. Growth of such thin films is characterized by an induction period, which is a consequence of the higher barriers that relate to the activation of the precursor on a non-native substrate. CVD is the preferred deposition method for fabricating optical storage, as it is a well established method with good scalability, reproducibility, and uniformity. It is also capable of high rates and good composition control.

1. Deo, N. et al. *Journal of Material Science* **2005**, 347-392.
2. Morita, H. et al. *J. Photochem. Photobiol., A* **2009**, 206, 205.
3. Ivanova, A. et al. *J. Electrochem. Soc.* **1999**, 146, 2139.
4. Londergan, A et al. *Journal of the Electrochemical Society* **2001**, 148 C21-C27.
5. Ivanova, A et al. *Journal of the Electrochemical Society* **1999**, 146 2139-2145.
6. AE Kaloyeros, A Londergan, B Arkles - *US Patent* 6,346,477, **2002**.
7. Ishizaka, T. et al. - *US Patent* 8372739, **2013**.

	Name	MW	bp °C/mm (mp)	D ₄ ²⁰	n _D ²⁰
	INCO030 COBALT CARBONYL <i>DICOBALT OCTACARBONYL</i> C ₈ O ₈ Co ₂ [10210-68-1]	341.95	45° / 0.1 sub (51-2° dec)	1.73	
	Contains 1-4% hexane for stability EC 233-514-0 HMIS: 3-3-1-X store <5°C				
	AKC238 COBALT(II) PHTHALOCYANINE C ₃₂ H ₁₆ CoN ₈ [3317-67-7]	571.47			
	Soluble: pyridine TSCA EC 222-012-7 HMIS: 2-2-0-X UV max: 677 nm				
	OMCO018 CYCLOPENTADIENYLCOBALT DICARBONYL C ₇ H ₅ CoO ₂ [12078-25-0]	180.05	37-38° / 2 (-22°)	1.35	
	Soluble: common organic solvents; insoluble: water EC 235-139-8 HMIS: 4-2-1-X store <5°C				
	AKZ946 ZIRCONIUM t-BUTOXIDE C ₁₆ H ₃₆ O ₄ Zr [2081-12-1]	383.68	70° / 2 Flashpoint: 85°C (185°F) Decomposes >100°	0.96	
	Vapor pressure, 26°: 0.06 mm HMIS: 2-2-1-X				
	AKZ953 ZIRCONIUM HEXAFLUORO-2,4-PENTANEDIONATE C ₂₀ H ₄ F ₂₄ O ₈ Zr [19530-02-0]	919.47	225° (41-3°)		
	Soluble: pentane HMIS: 3-1-1-X				
	AKZ965 ZIRCONIUM 2-METHYL-2-BUTOXIDE <i>ZIRCONIUM t-PENTYLOXIDE, ZIRCONIUM t-AMYLOXIDE</i> C ₂₀ H ₄₄ O ₄ Zr [24675-20-5]	439.78	138-9° / 5 Flashpoint: 114°C (237°F) Decomposes >225°C	0.961	
	HMIS: 2-1-1-X				
	OMRU027 DIETHYLRUTHENOCENE <i>BIS(ETHYLCYCLOPENTADIENYL)RUTHENIUM</i> C ₁₄ H ₁₈ Ru [32992-96-4]	287.37	100° / 0.01 (6°)	1.341	1.5870
	HMIS: 2-1-0-X store <5°C				
	AKR669 RUTHENIUM(II) CYCLOOCTADIENE BIS(2,2,6,6-TETRA-METHYL-3,5-HEPTANEDIONATE) C ₃₀ H ₅₀ O ₈ Ru [329735-79-7]	575.77	100° / 0.05 sub (187-190°)		
	HMIS: 2-1-0-X				
	OMHF075 HAFNIUM DIETHYLAMIDE <i>TETRAKIS(DIETHYLAMINO) HAFNIUM</i> C ₁₆ H ₄₀ HfN ₄ [19824-55-6]	467.01	130-5° / 0.1	1.249	
	HMIS: 3-2-1-X				
	AKH333 HAFNIUM 2-METHOXYMETHYL-2-PROPOXIDE <i>HAFNIUM MMP (MMP = METHOXY-t-BUTOXIDE)</i> C ₂₀ H ₄₄ HfO ₈ [309915-48-8]	591.05	135° / 0.1 (-5°)	1.303	1.4570
	Flashpoint: 67°C (153°F) HMIS: 2-3-1-X				
	OMTA075 TANTALUM PENTAKIS(DIMETHYLAMIDE) C ₁₀ H ₃₀ N ₅ Ta [19824-59-0]	401.33	100° / 0.01 sub (>150° dec)		
	HMIS: 3-2-1-X				
	OMTA084 TRIS(DIMETHYLAMINO)tert-AMYLIMINOTANTALUM C ₁₁ H ₂₉ N ₄ Ta [440081-38-9]	398.33	(36°)	1.430	
	HMIS: 3-2-1-X				