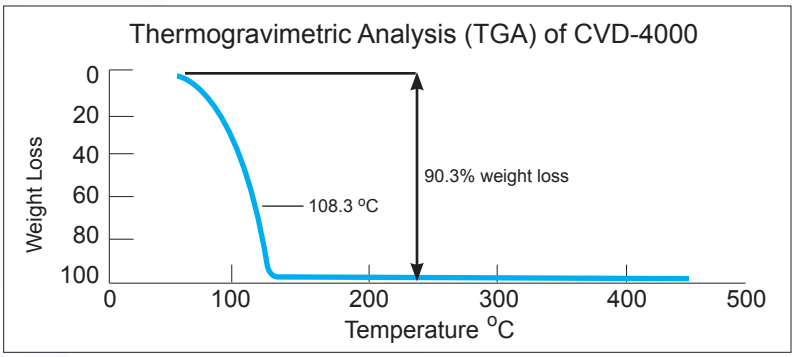
Starfire® CVD 4000

POLYMER-TO-CERAMIC™ TECHNOLOGY

Technical Data Sheet

CVD-4000 is a single-component liquid precursor for chemical vapor deposition (CVD) of high purity silicon carbide (SiC) on a broad range of substrates, including graphite, silicon, silicon oxide and some metals. A true technical and environmental breakthrough within the art of silicon carbide deposition by CVD, CVD-4000 is remarkably easy to use. CVD-4000's basic structure of [SiH2-CH2] in bonds leads to the formation of stoichiometric silicon carbide without the need for additional reactants. On the environmental side, CVD-4000 does not fume in contact with moisture, is not corrosive and does not produce corrosive HCl as a byproduct. It is stable and easy to handle in the air at room temperature. CVD-4000 greatly simplifies chemical vapor deposition of silicon carbide and reduces the associated risks to personnel, equipment and the environment.

Properties of CVD-4000	
Density	0.885 g/cm^3
Appearance	Clear liquid
Viscosity	1.52 cps
Solubility	Hexane, Toluene, THF
Flash Point	9°C (124°C)
Auto Ignition Point	140°C (284°F)
Boiling Point	50°C to 150°C at 1 Torr



High Purity Yields at Lower Temperatures

- Using CVD-4000, a 1:1 SiC coating can be deposited at temperatures as low as 600°C. Hydrogen content varies with deposition temperature.
- Since CVD-4000 is not corrosive and does not generate corrosive gases, it is able to provide high purity films free of the trace contaminants which arise from HCl corrosion of metal parts during conventional SiC CVD.
- Highly reproducible deposits are achieved in low cost glass or metal reactors using simple precursor delivery systems.

Greater Substrate Design Freedom

- CVD-4000 is especially suited for coating and infiltrating substrates which are unable to withstand the high temperatures (>1000°C) usually required for chemical vapor deposition of SiC.

Environmentally Safe, Easy to Handle and Less Corrosive

- The oligomer is not corrosive and does not emit irritating vapors. The need for solvents or secondary reactive gases is eliminated.
- Hydrogen is the only byproduct of CVD-4000 pyrolysis making it far more compatible with equipment, personnel and the environment.

Lower Maintenance Costs and Less Downtime

- Processing with CVD-4000 is more productive and efficient than processing with other precursors. This leads to higher productivity and the virtual elimination of the hidden costs associated with high maintenance and equipment downtime.

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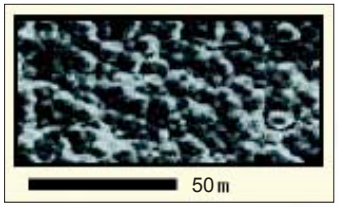
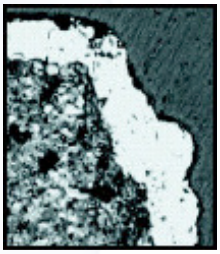
Benefits Of CVD 4000 As Compared To Methyltrichlorosilane (Mts) And Silane

	CVD 4000	Mts	Silane
Precursors	Only CVD 4000	MTS plus H2 (in exact ratios)	Silane Plus Methane (CH_4)
Precursors Hazards	Flammable (FP=9°C). Air, Moisture reactive at 140°C.	Corrosive, toxic, flammable (FP=3°C). Moist air and water reactive at 20°C.	Pyrophoric
% SiC in precursor	91% SiC (9%H)	27% SiC (71% CL, 2%H)	Silane - 87% SiC (13%H), Silane + Methane - 83% SiC (17% H_2)
By-products of CVD process	H_2	HCl (highly corrosive, must be neutralized) as well as H_2 and silanes	H2
Coating Composition	1:1± 0.5%	1:1±1.2% plus Cl and trace metals	1:01
Deposition Temperature	600-900°C	1000-1400°C	200-500°C
UN#	1993	1250	2203



Top surface of a SiC coating at 4000 X, prepared on graphite from CVD-4000 at 850°C.



Cross section of a typical SiC coating on graphite from a 30 minute CVD-4000 CVD run at 850°C showing the tightly bonded amorphous SiC layer.

Handling

The product safety information required for safe use of this product is not included in this document. Before handling, read the product handling information, the material safety data sheet (MSDS), and the container labels for safe use and physical and health hazard information. The MSDS and product handling information are available from Starfire Systems Inc.

Usable Life and Storage

Experience shows that STARFIRE CVD-4000 CVD precursor has a shelf life of a one year in freezer or six months at room temperature under nitrogen. The polymer slowly cross-links over time, increasing in viscosity and releasing small amounts of hydrogen. This process is accelerated in the presence of oxygen and water and at higher temperatures. If stored unopened for extended periods of time, venting of sealed containers is recommended.

Transportation, DOT and IATA Classifications
Flammable Liquid, N.O.S.
DOT Hazard Class: 3
DOT Label: 3
Identification: UN 1993
Packing Group: II

Packaging
Glass bottles (one to three liters)
Cans (15kg. net weight)
Drums (175kg. net weight)

Warranty

No analysis of this product is permitted. The data provided relates only to the material identified above, as supplied by Starfire Systems®, Inc. (SSI). Because conditions and methods of use of our products are beyond our control, this information should not be used as a substitution for customer's tests to ensure that SSI's products are safe, effective, and fully satisfactory for the intended end use. SSI's sole warranty is that the product will meet sales specifications in effect at the time of shipment.

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