

# Technical Specification of CVD Coatings – Hard Metals

## Titanium Carbide (TiC), Titanium Nitride (TiN), Titanium Carbonitride (TiCN) and Aluminium Oxide (Al<sub>2</sub>O<sub>3</sub>)

### Applications

TiC – used for cutting tools and improving the hardness of ceramics.

TiN – used for decorative coatings and cutting tools.

TiCN – used for abrasive and wear resistant coatings.

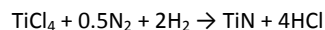
Al<sub>2</sub>O<sub>3</sub> – used for hard coatings.

### Properties

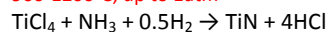
Coating	TiC	TiN	TiCN	Al <sub>2</sub> O <sub>3</sub>
Purity (%)	99.8	99.0	>99.9	99.9
Density (g/cm <sup>3</sup> )	4.9	5.2	4.2-5.2	4.0
Flexural Strength (MPa)	260	650	700	300
Hardness (Kg/mm <sup>2</sup> )	3000	2800	3200	2800-3000
Thermal Expansion Coefficient (10 <sup>-6</sup> /°C)	7.0-7.9	9.4	8.5	7.0-8.3
Thermal Conductivity (W/mK)	21	19	36	25-29
Electrical Resistivity (Ωcm)	5x10 <sup>-5</sup>	2.5x10 <sup>-5</sup>	2x10 <sup>-4</sup>	>1x10 <sup>14</sup>
Standard Thickness	4-12µm	5-7µm	1-5µm	4µm
Oxidation Temperature (°C)	600-1200	450	900-1000	n/a
Friction Coefficient	0.35	0.3	0.45	0.2-0.3
Colour	Black	Golden	Blue, grey, bronze	Gold, white

### CVD Methods

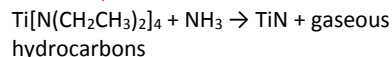
#### TiN



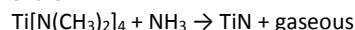
900-1200°C, up to 1atm



480-700°C, 1KPa



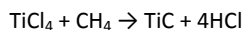
320°C



hydrocarbons

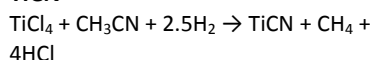
320°C

#### TiC



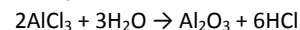
700°C

#### TiCN



700-900°C

#### Al<sub>2</sub>O<sub>3</sub>



CO<sub>2</sub> + H<sub>2</sub> at high temperature is used to give the small amount of water needed.

1050°C, 1Torr



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