

# Technical Specification of CVD Coatings – Group 5b

## Metals & Carbides

### Tantalum (Ta), Niobium (Nb), Tantalum Carbide (TaC) and Niobium Carbide (NbC)

#### Applications

Ta – used in aircraft and missile manufacture, wires, acid resistant coatings and surgical equipment.

Nb – used to join metal to ceramic, in superconductors and electric components.

TaC – used for coating steel moulds and sharp instruments with extreme mechanical resistance and hardness. Also used for coating graphite furniture used in LED production.

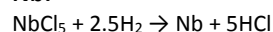
NbC – provides a hard, wear resistant, and corrosion resistant layer for use on steel substrates.

#### Properties

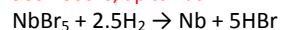
Coating	Ta	Nb	TaC	NbC
Purity (%)	99.9	99.9	99.9	99
Density (g/cm <sup>3</sup> )	16.6	8.57	15.0	7.82
Flexural Strength (MPa)	450	300	96-291	244
Hardness (Kg/mm <sup>2</sup> )	100-200	80-160	1790	2400
Thermal Expansion Coefficient (10 <sup>-6</sup> /°C)	6.5	7.1	6.3	7.0
Thermal Conductivity (W/mK)	54	54	22	14
Electrical Resistivity (Ωcm)	12.5x10 <sup>-6</sup>	12.5x10 <sup>-6</sup>	3.0x10 <sup>-5</sup>	3.0x10 <sup>-5</sup>
Standard Thickness	<0.5mm	<100µm	10-20µm	10-20µm
Oxidation Temperature (°C)	500	850	700	400
Friction Coefficient	0.88	0.46	0.52	0.40-0.66
Colour	Grey-blue	Grey	Black-grey	Grey

#### CVD Methods

##### Nb:

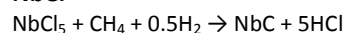


900-1300°C, up to 1atm



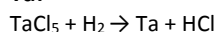
1200°C

##### NbC:



1500-1900°C

##### Ta:



900-1300°C, 10Torr

##### TaC:



550-600°C



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