

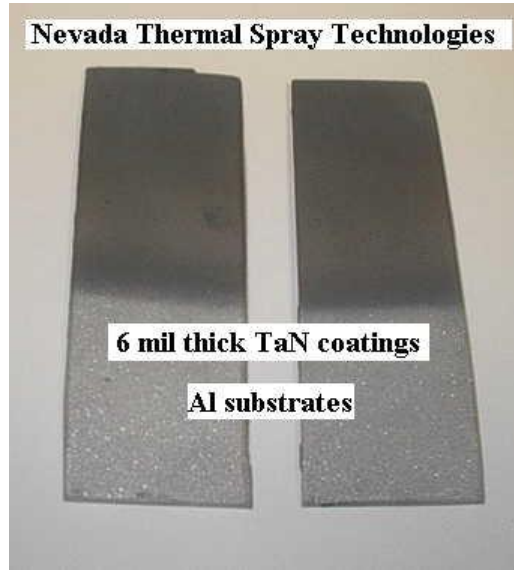


Nevada Thermal Spray Technologies

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NTST Tantalum Nitride (TaN) Coatings



General Information

NTST has developed the capability to fabricate tantalum nitride (TaN) coatings using the thermal spray process. TaN is hard, oxidation resistant, and chemically inert. The powder varies from brown to black with a crystal structure based on nitrogen composition. TaN films are normally fabricated using sputtering, high temperature synthesis, chemical vapor deposition, and physical vapor deposition.

Tantalum Nitride Applications

TaN has been widely used in the mechanical and microelectronics industries. TaN films and coatings exhibit good wear resistance, high hardness, corrosion resistance, and stable electrical resistivity. TaN finds application as a protective coating due to its excellent wear properties. It has found use as a diffusion barrier and insulating layer between copper interconnects in integrated circuit manufacture of computer chips. TaN is deposited on top of the silicon wafers during the manufacture of integrated circuits. Results have shown that TaN can stand up to 800C annealing without copper breaching through. It also has application in thin film resistors. It has the advantage over nichrome resistors in forming a passivating oxide film which is resistant to moisture. TaN applications for biomedical applications have been investigated for the fabrication of artificial heart valves.

Tantalum Nitride Material Properties

The electrical properties of TaN films vary from metallic conductor to insulator depending on the relative nitrogen ratio, with N rich films being more resistive. Tantalum nitride is insoluble in water. It has a high melting point of 3090 C and a density of 13700 kg/m³. The coatings are very hard with hardnesses varying due to the stoichiometry. Tantalum and its compounds are renowned for their resistance to corrosion by acids. TaN exhibits different stable and metastable phases (e.g., TaN, Ta₂N, Ta₄N) with different physical, chemical, and mechanical properties.