Nevada Thermal Spray Technologies
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NTST Aluminum Nitride (AlN) Coatings

General Information

NTST has developed the unique capability to fabricate AlN coatings using thermal spray processes. AlN is normally produced by dry pressing and sintering, yielding a material that is stable at high temperatures. It is a high-performance material particularly suited to demanding electrical applications. AlN is difficult to fabricate as a coating due to its tendency to sublime at high temperatures. NTST AlN coatings have been applied to a variety of different substrates including aluminum, carbon steel, stainless steel, copper, and aluminum nitride.

AlN Material Properties and Characterization

The material properties of AlN make it suitable for a range of industrial applications. AlN material properties include very high thermal conductivity, strong dielectric properties, a thermal expansion coefficient like silicon, good corrosion resistance, and stability at high service temperatures. AlN is a preferred choice for substrate and thermal management applications due to its high thermal conductivity and unique high electrical resistivity.

Characterization for NTST AlN coatings is limited. The coating thermal conductivity determined using laser flash +ACY- standard TIM-type thermal conductivity measurements is approximately 80 W/m-K. The coating hardness is 7.5 mohs, as-sprayed roughness ranges from 205 to 395 microinches as a function of thickness, measured dielectric strength is 300 volts/mil, and bond strength exceeds 4500 psia.

Flexural strength (i.e., bend strength) is defined as the stress in a material just before it yields in a flexure test. The transverse bending test is most frequently employed, in which a specimen is bent until fracture. This represents the highest stress experienced within the material at the moment of yield. Typical values for AlN maximum flexural strength varies from 250 to 320 MPa. Figure 1 illustrates the NTST bend test for AlN.

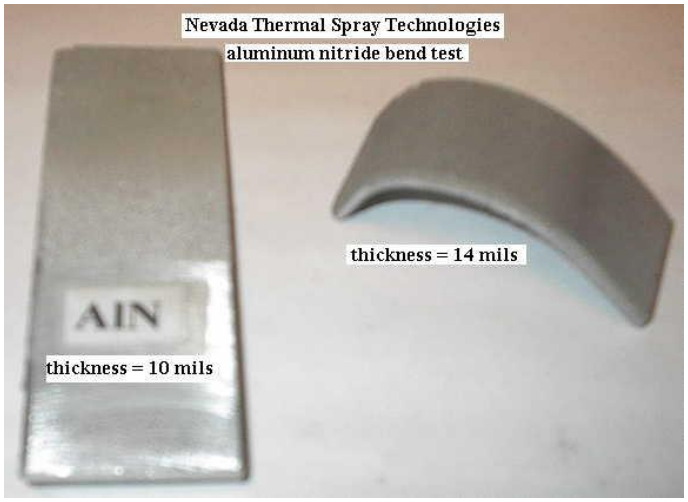

Figure 1. NTST AlN Bend Test.

Figure 2 illustrates typical NTST AlN Coatings

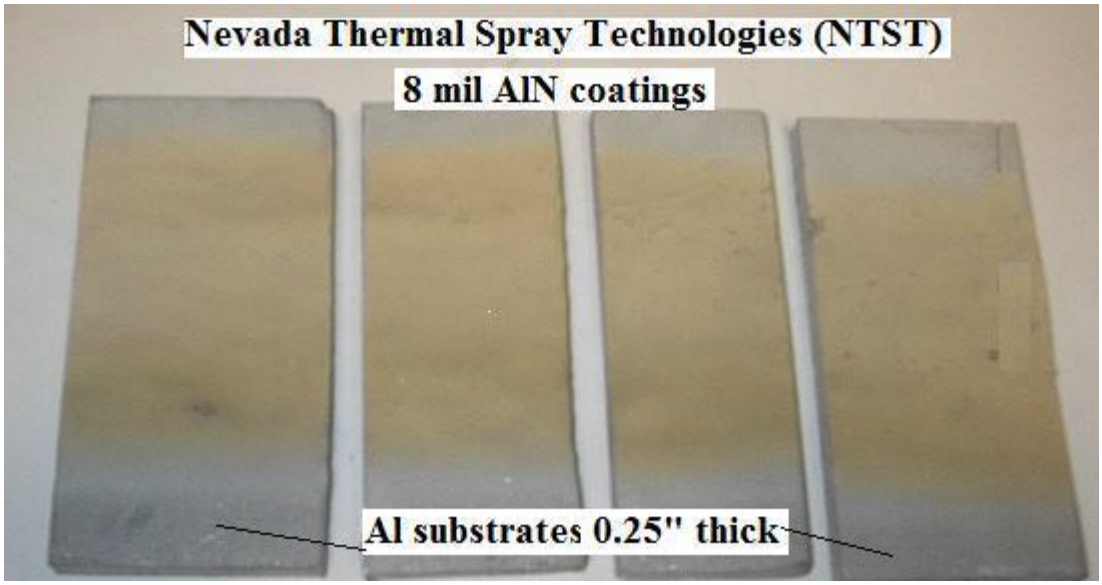

Figure 2. NTST AlN Coatings.

NTST Materials Information:

Materials information listed below is taken from various sources. This includes coating, thin film, and free form data. These listed properties are only approximate and vary substantially for thermal spray coatings. Further materials characterization needs to be conducted on the NTST AlN coating for each customer's unique application.

Mat	Hard Mohs	Rough Micro-inch	Decomp T F (K)	Density Kg/m3	TherCond W/m-K	CTE C	Dielec Const	DielecStr V/mil
AlN	7	Rz1595 Ra 319	3990 (2470)	3260	80	4.5	9	300

AlN Applications

AlN is a critical advanced material for many applications. It is principally used for electronics applications when heat removal is an important function. Other AlN applications include optics, lighting, dielectric, military, semiconductor manufacturing, and steel manufacturing. Typical AlN components include crucibles, heat sinks, electronic substrates, IC packages, power transistor bases, and microwave device packages.