AeroTek Manufacturing Ltd.

ION VAPOUR DEPOSITION (IVD-Al)

OVERVIEW

The need for environmentally friendly solutions to everyday problems is a growing concern in the 21st century. For the protective coating industry Ion Vapour Deposition (IVD-Al) is the answer as it provides effective corrosion protection by bonding pure aluminum onto metallic and non-metallic substrates. IVD-Al provides a high quality, safe and reliable solution for coating metals versus Cadmium, Zinc, and other sacrificial coatings. IVD-Al continues to be the solution for environmentally friendly protective coatings used in civilian and military aircrafts.

IVD-Al has been in service for 30 years and usage is growing as more innovative uses are discovered in which a high performing coating is required to provide superior corrosion protection, smooth uniform coating thickness, electrical conductivity and excellent metal adherence, in a completely environmentally friendly manner.

THE IVD-Al PROCEDURE

The process: Regardless of chamber size, the process is the same. The procedure begins by degreasing the parts, followed by a light aluminum-oxide or water seal grit blasting. Parts are then placed into the IVD-Al chamber, followed by glass beading and a chromate seal is applied to complete the process.

IVD-Al process: The IVD-Al process begins by cleaning and hanging the parts in the IVD-Al vacuum chamber. The chamber is then pumped to a vacuum of $8x10^{-5}$ and filled with inert argon gas. A glow discharge cleaning then takes place to ensure complete surface cleanliness prior to coating, the chamber is then cooled. Ceramic vaporization boats, are then heated and 99.9% pure Aluminum wire is fed on to the boats, at a controlled speed, releasing vaporized aluminum into the argon gas filled vacuum. During the vaporization burn process, the boat rack moves through the chamber to ensure an even distribution of the vapor within the IVD-Al chamber. When the prescribed number of passes is completed, the chamber is cooled, and the process repeated until the desired thickness of IVD-Al is deposited on the parts. The chamber is then vented and the parts removed for subsequent burnishing and sealing.

IVD-Al APPLICATION

IVD-Al can be applied to a wide variety of metallic substrates such as aluminum alloys, steel, titanium and magnesium. IVD-Al can be used to coat polymers, glass, ceramics and plastic composite substrates without thermal or electrochemical damage. IVD-Al can perform in a wide range of operating environments and on many various substrates which is only more reason to use IVD-Al.

Common metallic substrates use:

IVD Aluminum On	Benefits
Steel	'Sacrificial' corrosion resistance, zero hydrogen embrittlement. A 0.001-0.002 inch coating average 7500 hours in 5% neutral salt at an operating temperature up to 925°F.
Heat and Corrosion Resistant Alloys	Equal to steel with the exception that it offers oxidations resistance at high temperatures, up to 925°F.
Titanium	Equal benefits as steel. This coating can be hard anodized, providing benefits found by anodic coatings on aluminum. It also retards titanium combustions and permits painting and adhesive bonding.
Aluminum	Adds corrosion resistance to high strength aluminum alloys while maintaining fatigue resistance. Allows the use of casting and microcrystalline alloys. Corrosion resistance where electrical continuity or bond is required.
Magnesium	Able to replace anodic and conversion coatings as a pre-treatment for paint or solid film lubricant application.
Other Applications: 300/400 Series Stainless Steels, 17-4 pH, Inconel, Nickel, Hastelloy, MP35N, Nitronic 50, Nitronic 60, Molybdenum, Tungsten.	

AeroTek is presently testing IVD-Al on graphite/carbon-fiber products.

ADVANTAGES OF IVD-Al

Environmentally, aluminum is very safe and is nontoxic to humans in raw or processed form. When used in the IVD-Al process it generates no toxic waste as a by-product. By using IVD-Al, it eliminates the risk of working with cadmium or other heavy metals which are hazardous to humans, as well as the cyanides contained in many plating solutions.

PERFORMANCE

A 0.001 – 0.002 inch coating	IVD	Cadmium
Operating Temperature °F	925 °F (496.1 °C)	350 °F (176.67 °C)
Burnishing Pressures (PSI)	90 psi (620.53 KPa)	40psi (275.79 KPa)

IVD ADVANTAGES AND LIMITATIONS

Advantages	Limitations
Outperforms Cadmium in Real Service Tests as well as Acidic Fog	IVD aluminum does not provide an erosion-resistant surface, like chrome.
Continuous service temperature of 925°F (500°C), IVD aluminum on titanium offers high temperature.	Difficult to coat interiors of blind holes that have a depth greater than one diameter.
No hydrogen or solid metal embrittlement is induced	
Alleviates dissimilar metal problems and galvanic corrosion.	
Zero fatigue reduction factor for aluminum parts as found by anodize	
It is conductive	
There is zero sublimation of the coating in a space environment	
Features a superior wrap around coating and is not detained by line of sight.	

AEROTEK'S CAPABILITY

AeroTek has been applying IVD-Al for over 30 years, the sole provider of IVD-Al in Canada and one of the few in North America. AeroTek is one of the largest IVD facilities operating with four IVD machines, two with barrel coater inserts and a stand-alone barrel coater with automatic feeder. AeroTek continues to research and develop new IVD-Al applications for customers, which include Pratt & Whitney, Airbus, Boeing, Bombardier, IBM, and many other aerospace and industry OEM partners. IVD-Al superior performance in aerospace and military applications makes it easily adopted by the pharmaceutical, marine, nuclear, chemical, petrochemical, semiconductor, biotech, transport and other industries.

IVD-Al has recently been used to metalize ceramics and with the introduction of new substrates its uses will spread into new industries and continue to grow. AeroTek continues to lead in researching and developing new applications as IVD's potential remains largely untapped.

For over 50 years, AeroTek has been commited to providing superior protective coating solutions that are safe for people and the environment. This is all provided with fast lead times and competitive pricing. Contact us and find out what AeroTek is doing for your industry today, tomorrow, and in the future.

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