Lower Cost and Environmental Impact

The aerospace industry is increasingly focused on reducing carbon footprint, maintenance and total operating costs. Advanced materials are key contributors to achieving the goals of lower weight, extended life and reduced fuel consumption.

Ionbond continues to be at the forefront of the engineering of surface treatments enabling the use of conventional and alternative lightweight materials to increase performance and reduce the overall cost of ownership. Unlike many conventional surface finishes PVD technology is environmentally friendly with no toxic by products.

Hard chromium replacement technology

Ionbond Tribobond™ PVD coatings exhibit properties that meet or exceed the hard chromium they replace and can be specifically optimized for each application. For example; Tribobond™ 30 (CrN) with a typical thickness of 5–10 microns is much thinner than hard chromium, offers increased hardness, a reduced coefficient of friction and enhanced adhesion with less tendency to crack. Fine features like threads, recesses etc. are maintained. Unlike with hard chromium plating there is no need to machine back to size which results in shorter manufacturing time and lower overall component cost.

Quality assured

Ionbond facilities hold an extensive range of international accreditations, including ISO 9001, AS 9100, ISO 9002, and NADCAP. Ionbond also holds numerous major aerospace systems and component supplier approvals. We are pleased to work in partnership with our clients developing solutions, processes & procedures to meet their individual needs.
State of the art PVD, CVD, and PACVD coatings for Aerospace applications

Improved Performance and Capability

**Harsh environment**

Combined with superior metals used for the base components, Ionbond Tribobond™ coatings are the surface treatments of choice for longer lifetime and better efficiency. Films are routinely being applied to enhance the components properties. They can be designed to provide thermal barrier or transfer properties across a wide range of load and temperature conditions. Typical applications include engine and mechanical parts, bearings and actuators.

- Reduced friction, galling, erosion and fretting
- High temperature resistance
- Chemically inert

**Extended lifetime**

Many systems on aircrafts are subject to dust and dirt contamination, and both mechanical and thermal shocks. Tribobond™ 40, an amorphous diamond like carbon coating, has superior self lubrication characteristics and hardness (compared with conventional, lubricated metal surfaces), exhibits lower wear and extends overall service life and maintenance intervals. The use of such coatings reduces operating costs, spares inventories, maintenance times and complexity resulting in cost optimisation and minimum environmental impact.

- Increased surface hardness
- Self lubricating
- Low wear properties
Diffusion coatings for turbine blades

Turbine blades are the hottest parts in jet engines and are exposed to extremely tough conditions. Even inside the cooling channels super alloys based blades fail by hot corrosion. Ionbond offers coating services and sells CVD equipment to provide efficient protection in such critical areas. As opposed to the conventional packing method the CVD applied coatings exhibit uniform thickness. The aluminum based diffusion coatings with self-healing feature provide extended lifetime to blades. Doped and alloyed coatings are available, customized to the particular needs.

- Higher temperature operation
- Increased fuel efficiency
- Reduction of hot corrosion

Cutting tools for modern material machining

Composite materials and hard metal alloys are increasingly being used in airframes and aerospace components to improve performance and reduce environmental impact. Ionbond has developed special coatings for such tools to extend the lifetime and increase the productivity.
## Ionbond Aerospace Coatings

<table>
<thead>
<tr>
<th>Technology</th>
<th>PA-CVD</th>
<th>PVD</th>
<th>CVD</th>
<th>Arc-PVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coatings</td>
<td>Tribobond™ 40, 41</td>
<td>Tribobond™ 01, 20, 30</td>
<td>Bernex 66</td>
<td>Ionbond™ 08</td>
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<tr>
<td></td>
<td>Cr/a-C:H:W</td>
<td>TiN, TiAIN, CrN</td>
<td>Al</td>
<td>TiSiN Hardcut</td>
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<tr>
<td></td>
<td>Cr/a-C:H:W+a-C:H</td>
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<td></td>
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<tr>
<td>Structure</td>
<td>Gradient DLC : WC/C</td>
<td>Columnar/Nano-grains</td>
<td>Crystalline</td>
<td>Multi-layer with Nano-composite TiSiN</td>
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<tr>
<td></td>
<td>aDLC with underlayers,</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Cr or CrN</td>
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<tr>
<td>Cross Section</td>
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<tr>
<td>Micrographs</td>
<td></td>
<td></td>
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<tr>
<td>Deposition Temperature</td>
<td>&lt; 200 °C</td>
<td>200 – 450 °C</td>
<td>800 – 1050 °C</td>
<td>450 °C</td>
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<tr>
<td>Characteristics</td>
<td>Amorphous top layer</td>
<td>Columnar structures</td>
<td>Excellent adherence</td>
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<tr>
<td></td>
<td>High hardness</td>
<td>Tunable hardness</td>
<td>High thickness possible</td>
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<tr>
<td></td>
<td>Low friction coefficient</td>
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<tr>
<td></td>
<td>Hardness gradient</td>
<td>Temperature resistance</td>
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<tr>
<td></td>
<td></td>
<td>(500 – 900 °C)</td>
<td>Uniform thickness</td>
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</tr>
<tr>
<td>Wear mechanisms</td>
<td></td>
<td></td>
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<tr>
<td>Fatigue (impact)</td>
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<td>✓ ✓</td>
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<td>Adhesive (galling/scuffing)</td>
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<tr>
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<tr>
<td>Component applications</td>
<td>Landing gear</td>
<td>Bearings</td>
<td>Turbine blades</td>
<td>Cutting</td>
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<td>Bearings</td>
<td>Fasteners</td>
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<td>Machining operations for:</td>
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<tr>
<td></td>
<td>Gears</td>
<td>Seals</td>
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<td>Carbon fibre materials</td>
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<tr>
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<td>Seals</td>
<td>Control mechanisms</td>
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<td>Titanium based alloys</td>
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<tr>
<td></td>
<td>Hydraulics</td>
<td>Thrust reverser</td>
<td></td>
<td>Nickel based alloys</td>
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</tbody>
</table>

For a complete coating listing please see www.ionbond.com
Competence and Innovation – Worldwide

Ionbond is a leader in surface enhancement technology and provides advanced coating solutions featuring a broad range of hard, low friction, wear resistant coatings based on PVD, PACVD and CVD technologies for a wide range of applications. It has a global presence with coating centers in strategic locations across Europe, Asia, and North America and has one of the largest coating networks in the world.

Ionbond is part of the IHI Group, a Japanese industrial group with significant R&D resources that operates through multiple business fields including: Energy and Resources, Social Infrastructure, Industrial Machinery and Aero Engines.

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