

## SPECIALTY COATINGS

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LED RAYS engineers & manufactures best in class solid state lighting solutions using advanced processes, techniques and materials for the industrial, harsh/extreme environment and Hazardous location markets.

For example, LED RAYS has engineered high temperature LED fixtures which can safely operate at an incredible 112°C (233°F) and has created subsea exploration LED luminaires with over 240,000lm output in a package that can comfortably withstand 6,100m (20,000ft) immersion in sea water. Extreme environmental applications such as these were successfully deployed by implementing specialty coatings.

LED RAYS offers a multitude of advanced coatings and barrier materials which are application specific.

The choice of a specific coating depends on the substrate to be protected, and the level of required protection necessary to meet operational performance under in situ environmental conditions. The properties of the base material must also be considered prior to selecting a coating.

The following is a partial list of properties which can be affected by coating:

- **Wear Resistant:** Designed to resist wear or erosion.
- **Vibration Control:** Harmonic, wind or high velocity air flow induced.
- **Waterproof / Water Repellant:** Minimizes or eliminates the penetration of water into an object.
- **Surface Protection:** Reduce or prevents damage caused by scratching, corrosion, abrasion, erosion, scuffing, denting, chipping, impacts, shocks, delaminating or other processes.
- **Conducting or Insulating:** Forms an electrically conductive or insulating layer.
- **EMI / RFI Shielding:** Provides shielding from electromagnetic interference (EMI) or radio frequency interference (RFI).
- **Anti-Static / ESD Control:** Minimizes static electricity in sensitive environments.
- **Chemical Resistant:** Resists acids, alkalis, oils, and other general chemicals.
- **Antimicrobial and Antifouling:** Surface contains an agent that inhibits the ability of microorganisms to grow on the surface of a material or a protective layer to inhibit growth and fouling from various organisms.
- **Corrosion Inhibiting:** Prevents moisture from reaching the metal or underlying substrate.
- **Flame Retardant:** Reduces the spread of flame or resist ignition when exposed to high temperatures.
- **Heat Resistant:** Resists damages from heat, or are formulated for use in high-temperature environments.
- **General Protection:** Designed to protect objects and their different surfaces for long term durability.
- **Weather Resistant:** Protects against damage from UV radiation, atmospheric contaminants and particulate deposits.

The following are the most popular specialty coatings used by LED RAYS to meet specific operational performance, reliability and longevity requirements and afford a combination of aesthetics and durable protection.



## **FLUOROCARBON:**

Fluorocarbon surface technologies are applied on any metal or alloy surface, which can be suitably pretreated by blasting, anodizing, phosphating or Soft Nitriding/Nitrocarburising. Fluorocarbon Coating performs well under a multitude of extreme environmental conditions.

Fluorocarbon treatment using fluoropolymers such as ECTFE, ETFE, PFA, PTFE coatings provides robust resistance to chemical attack, impervious to water, oil and high humidity environments and most liquids, is very stable in high-temperature applications and offers superior resistance to abrasion and wear. Dust and debris do not adhere to parts which are treated with fluorocarbon.

Fluorocarbon coating is lightweight and provides high adhesion, it protects against fading, flaking, cracking, peeling and offers uniform color distribution. Additionally, it is shockproof, dustproof, fireproof and provides heat and sound insulation.

Optimum film thickness is 15-30 microns. Capable of over 200°C operation

Exceptional mechanical, abrasion, thermal and electrical performance.

Antimicrobial, Low friction, Corrosion, Chemical resistance, Cryogenic stability.

Superior Electrical properties, Heat resistance, Water resistance, Non-stick/release, Anti-galling.

Suppliers: Emralon®, Chemours (Teflon®), PTFE, Xylan®, Whitford (Xylan®), Solvay (Halar®), Arkema (Rilsan®) and Thermolon®.

## **SUPERHYDROPHOBIC:**

Superhydrophobic surface treatment is a thin surface layer that repels water. Superhydrophobic coatings rely on a delicate micro or nano structure to achieve their repellence and are based on the “lotus effect”.

It is made from superhydrophobic (ultrahydrophobicity) materials. Droplets hitting this kind of coating can fully rebound. They work by creating a micro or nano-sized structure on a surface which has super-repellent properties.

Two Greek words are combined to describe the term hydrophobicity, one is hydro that means water and phobos that means fear. Hence hydrophobic surfaces can be defined as material that tend to repel water. Superhydrophobic materials possess large contact angles above 150 degrees and are difficult to wet.

Three types of Superhydrophobic methods are in use, silica-based coatings which are cost effective, oxide polystyrene composites which offer more durability but involve more complex processes and equipment and carbon nano-tubes and graphene-based 3D aerogels which generate high expenditures and application difficulty. However, they provide unique and valuable properties which the other two methods cannot achieve.

Superhydrophobic coatings provide advanced protection in ultra-dry surface applications. Protection properties are waterproof, anti-icing, self-cleaning capability, repels many types of contaminants including biofouling and is an ionic barrier.

Supplier: Custom LEDRAYS Formulation

## **POLYUREA:**

Polyurea is a type of elastomer using long chained molecules in a two-component system which provide an extremely tough and resilient long-term coating solution. Perfect for the protection of metal components where the application demands protection from external forces such as impacts, shocks, elevated chemical attacks and corrosion protection.

Properties include self-healing, mitigation of blast, fragmentation, shock and impacts. Noise containment and vibration control. Dent and scratch mitigation, very high chemical resistance, high friction and wear resistance (slip and skid), fire retardant (high temperature capable), waterproof barrier resisting corrosion, high elasticity and elongation capability (5x), no chipping, peeling or defect formation, better UV protection than polyurethane, used both in exterior and interior atmospheric services. Can provide contraction and containment of impacts and projectiles provides extreme weatherability.

Polyurea do not contain any solvent or Volatile Organic Compounds (VOC). Two-Component polyurea elastomer systems are amorphous in nature, not crystalline like polyurethane systems. Broad spectrum application or targeted formulation can be achieved based on application, these can be ester, epoxy, silicone or a combination of proprietary modifications to the polymer chain

Layering is possible up to a film thickness of 1.5-100mm. Capable of -65°C to 140°C, 40 MPa (6000 psi) tensile strength.

Suppliers: Paxcon®, Armorthane®, GLS 100R, and Pentens SPU-1000

## **CERAMIC:**

Ceramic substrate coatings are used in aggressive industrial applications. Ceramic coatings are generally applied to metal surfaces to protect them from wear and tear, damage due to high temperatures, and/or corrosion and chemical attack in harsh environments. Protects and preserves surfaces exposed to harsh environments in extreme climates and where high contaminants may be present.

Ceramic treatments provide good electrical insulation, heat, and wear resistance. The resultant finish is ultra-smooth and high gloss, epoxy-based with long term protection characteristics. Ceramic coatings offer protection against thermal shock, high heat capability and improves durability, staves off rust, corrosion, and dulling from metal surfaces with a high heat.

Wear-resistant ceramic coatings provide exceptional protection against mild abrasion and friction and increase equipment efficiency and life expectancy. Reduces drag, erosion and can provide anti-icing capability. Has high strength and fracture toughness combined with high hardness. Clear coatings provide an effective barrier against vapor and moisture and salts for bare or polished metal surface such as blasted steel, aluminum, brass or other metal surfaces.

Common ceramic coatings include alumina, titania, zirconia, alumina-magnesia, hafnia, silicon carbide, silicon nitride, and boron carbide, as well as oxides of many of these materials.

Ceramic coatings can be applied at thicknesses ranging from a few to several hundred microns. Common application methods include physical vapor deposition (PVD), chemical vapor deposition (CVD), thermal spraying, plasma

spraying dipping, sol gel, micro-oxidation, packed diffusion, ionic beam surface treatment, and laser assisted techniques.

Designed for a wide variety of operating environments, wear-resistant coatings fall into seven distinct categories: putties with beads, high-temperature formulations, ultra-high-temperature formulations, fast-set materials, brush-on formulations, sprayable formulations, and impact-resistant materials.

Ceramic coatings resist harsh chemicals and withstand temperatures of 230°C and up to 2500°C. Formulation offer variable bead size based on wear requirements

Suppliers: CP®, ASB®, Endura®, Infused matrix™, BASF®, PPG®, AN®



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