“Tune-able” Hybrid™ Coatings for Light Metal Components

Hybrid™ Coatings

The Hybrid™ coating is a new approach to producing thin, functional coatings on light metal surfaces. It is so-called as it is a combination of anodisation and electro-deposition. By manipulating the growth of anodising pores in the alloy, we can form a structure that will accept electro-deposition that will grow from the substrate up through the nano-tube array. As we adjust the deposition variables, we can then deposit crystallinity and orientation to ensure nano-pores are completely filled and the electrical and adhesive bond to the part is strong.

Hemispherical Hybrid™ Coatings

By manipulating the pore density and deposition structure of different Hybrid™ coatings, we can form a “tune-able” hemispherical morphology.

New Research - Hybrid™ Deposited Riblets for Drag Reduction

Recently, Cirrus has been investigating the potential to tune the Hybrid™ coating to produce surface features similar to “riblets”. This effect, found on certain leaves and shark skins, can reduce drag through air or water. Early tests with hemispherical coatings have produced approx. 5% drag reduction. We expect this can be improved substantially with further tuning.

Standard Hybrid™ Coatings

Standard Hybrid™ coatings are flat, and have an “interlock” layer usually of nickel or copper that is deposited into the pores. The outer layer may be any other metal suitable for deposition. Standard Hybrid™ coatings are 6um—10um in total thickness, and provide protection and conductivity. The nickel coatings in these pictures offer excellent wear and corrosion resistance, strong adhesion to the substrate, and perform well in thermal shock, and lightning tests.

The key to producing high performance Hybrid™ coatings is to ensure a strong interlock between the substrate, the anodising structure, and the functional top layer. This is achieved by regulating the size and density of the pores, and ensuring all nanotubes are completely filled by the interlock deposit.

Black Hybrid™ Coatings

Black Hybrid™ coatings can be formed in multiple ways. Here the anodising has been tuned to fine density and nano-particle nickel deposited across the surface. The resulting morphology and increased pore density absorbs a broad spectrum of UV and visible light.

Hybrid™ Coatings for Titanium

Black Hybrid™ coatings also be produced by depositing standard black nickel into the anodising pores. This method will create a durable black nickel surface, that can be further enhanced with the inclusion of Cirrus Dopant™ nano-particle reinforcement.