First Surface Flexible Optical Solar Reflectors with ‘Interferential CERMET’ coatings

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ABSTRACT

We report on a new type of fully inorganic thin film multilayer coating called ‘Interferential CERMET’, based on ceramic and ceramic-metal (CERMET) materials, deposited by magnetron sputtering, and characterized by low solar absorption $\alpha = 0.1$, high IR emissivity $\varepsilon = 0.8$, good electrostatic dissipation properties (sheet resistance = 5-10 K\Omega\text{ / square}), and extreme durability against high temperature, UV rays and charged particles.

The coating was initially developed in the frame of the Bepi Colombo program, and qualified as a specialty white paint for components of the HGMA antenna feed, for deployable thermal covers, and for hold-down & release mechanisms. In that context, the coating showed only 2% alpha degradation after 26,000 Equivalent Sun Hours at 350°C.

More recently, in the frame of an ARTES 5.1 project, the coating has been adapted and optimized for deposition on flexible foils of thickness 2-3 MIL, made of a variety of materials, from polymers like polyimide and PEEK, to metals like Aluminum and Titanium, to Carbon Fiber Reinforced Polymers.

Furthermore, the process has been scaled up from a lab plant to an industrial plant with a production capacity of 3.5 m² of foil / batch, and a cycle time of around 24 hours.

Pre-qualification tests show that the coated foils withstand thermal and humidity cycles, and can be comfortably handled, bent, and glued onto radiator panels without adhesion loss or degradation of thermo-optical and electrical properties.

These results make the new technology extremely promising for Optical Solar Reflector applications, as it combines the performance and durability of the traditional 4 cm x 4 cm metalized quartz tiles (that are brittle and have high AIT costs), with the flexibility and ease of use of the Silver/Teflon foils (that age rapidly in space). Direct application of the coating onto the outer Aluminum or CFRP skin of radiator panels constitutes an alternative and possibly even more appealing use of the same technology.