Hybrid glass/graphene coatings with enhanced electrical and thermal conductivities

CSIC and Aernnova Engineering Solutions SA have developed a new hybrid coating based on a glass matrix with a volume of graphene nanoplatelets content below 4 vol% that confers it with a high electrical conductivity ($1.4 \times 10^2$ S.m$^{-1}$), thermal resistance at temperatures above 1300 °C and high corrosion resistance in harsh environments. These properties make this material very attractive for different applications in the aeronautic and aerospace industries and also as bond interface in electronic and / or energy systems.

**Companies for the exploitation of this technology through patent license are sought**

**Description of the Technology**

The incorporation of graphene based fillers into glass, ceramic or glass-ceramic materials improve their thermal and electrical performance. However, the development of this kind of materials as coating is still very limited.

In the present invention, a procedure for obtaining glass (ceramic)/graphene hybrid bulk materials and coatings has been developed by using flame spraying of spherical shaped granules consisting of an homogeneous mixture of the glass precursor oxides (YAS) and graphene nanoplatelets (GNPs).

Coatings/materials presenting a good dispersion of the graphene sheets oriented parallel to the lamellas forming the glass matrix is obtained by a one-step process. Graphene sheets are arranged forming an interconnect network throughout the length and thickness (100-200 µm) of the coating. Thus, a spectacular increment of 15 orders of magnitude is obtained for the electrical conductivity of the coating (up to $1.4 \times 10^2$ S.m$^{-1}$) for GNP contents below 4 vol%. This is the first time that such high values are reported for inorganic coatings with similar graphene concentrations. In addition, these hybrid coatings show an increment of 30% in the thermal conductivity and also a reduction of the elastic modulus which enhances their performance under external loadings.

**Main applications and advantages**

This technology allows, in just one step, obtaining coatings/materials with graphene as filler by thermal spraying techniques with the technological advantages of using a technology widely implemented in aerospace industry. The improvements in the properties encourages their promising application in fields like aeronautic, aerospace or even in nuclear industry, and in particular as:

- Thermal shield in aerospace (Thermal Protection Systems, TPS)
- Electromagnetic/Radiofrequency Interferences shielding (EMI/RFI) or lightning strike protection.
- Thermal management systems
- Environmental protection (Deicing)

They can be also used as bond interface in electronic and / or energy systems.

**Patent Status**

Patent filed

For further information please contact

Marisa Carrascoso Arranz
Área de Ciencias de Materiales
Vicepresidencia Adjunta de Transferencia del Conocimiento (CSIC)
Tel.: + 34 – 91 568 15 33
Email: macarrascoso@orgc.csic.es