

# **Erosion-wear, mechanical and thermal properties of silica filled epoxy nanocomposites**

J. Abenojar, J. Tutor, Y. Ballesteros, J.C. del Real-Romero, M.A. Martínez

**Abstract—** Different nano- and micro-fillers are added to modify the mechanical properties, wear resistance, thermal properties and the curing process of polymers. A very important application for epoxy resins is to be used as coating for anti-cavitation painting. Pyrogenic silica is already used in adhesives and paints, being its application related to rheology. The objective of this work is to study the effect of pyrogenic silica on epoxy resins, usually not present in their formulation. SiO<sub>2</sub>/epoxy nanocomposites with two different loads of nano-silica, 3 and 5 wt% were manufactured. In particular, the study focuses on the influence that the addition of nano-silica has on the mechanical, wear and cavitation erosion properties as well as on the thermal properties and the curing reaction. To accomplish these goals, nanocomposite samples in bulk and as coating were prepared. Mechanical properties (hardness, bending and tensile strength), wear resistance (in bulk and coating) and cavitation erosion were evaluated. The epoxy curing process and the influence of nano-SiO<sub>2</sub> additions on the glass transition temperature (T<sub>g</sub>) were studied by Differential Scanning Calorimetry (DSC).

In general, a plasticising effect was observed with nano-silica addition. Moreover, the resistance to erosion by cavitation, in terms of cumulative erosion and erosion rate, was higher for the nanocomposites than for clear resin.

**Index Terms—** Polymer-matrix composites; Thermosetting resin; Nano-silica; Wear; Thermal properties; Mechanical properties; Mechanical testing; Thermal analysis

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