EFEVE: Development of a new high performance material to make super strong and lightweight components

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The use of different nanoreinforcements for aluminium (Al) and magnesium (Mg) alloys is being approached in the frame of the FP7 EU project EFEVE.

Two different kinds of nanoreinforcements have been investigated and developed: on one hand carbon based nanoreinforcements, on the other hand non-carbonaceous materials. The selection has been carried out in two phases. In a preliminary selection, based on bibliography review and previous experiences, four reinforcements have been investigated (nanodiamonds, titanium carbide, alumina and boron carbide) to finally select one reinforcement for each considered matrix alloy (Al and Mg). The general objective of the project is to develop high performance Mg and Al components for automotive, wind energy and construction applications. Redesigned components will take advantage of the enhanced mechanical properties provided by the combination of advanced foundry processes and nanoreinforced alloys. The application of nanodiamond powders as Al and Mg reinforcements has its own specific features. The size of primary nanodiamond particles is in the range of 5-6 nm but they tend to form large agglomerates of up to 50-100 micrometers. During mechanical alloying in planetary mill, large agglomerates are broken into very fine agglomerates of several primary nanodiamond spherical particles, or even into separate diamond nanoparticles. In the case of TiC particulates the SHS process makes it possible to create a master alloy composed of pure Al and up to 70% of carbides, produced in situ with a high degree of purity. The results of this phase of the project and the preliminary trials on the incorporation of these nanoreinforcements into Al and Mg alloys are presented together with the correspondent microstructural analysis.

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