

Title: Forging of Magnesium Matrix Composites

Subject of the research

A collaborative research between LIEBHERR Aerospace Toulouse (France) and PALBAM-AMTS (Israel) for development of high performance magnesium alloys components. The technology is based on forging of magnesium matrix reinforced by SiC particles.

Background

Metal Matrix Composites (MMC) are widely known to show superior physical and mechanical properties. Due to the increasing demand to lightweight materials in the aerospace and automotive applications, magnesium alloys, which demonstrate good castability with high specific strength, gain increasing attention in these industries. Among the techniques available to synthesize MMCs, solidification processes are particularly attractive due to their simplicity, economy and flexibility. Hence, the solidification microstructures have important effect on the properties of the MMCs.

A new method of magnesium based MMC production is investigated in this work. This method is based on introducing the SiC particles into the melt while the magnesium alloy is at semi-solid state in order to avoid segregation. A vigorous agitation applied on the semi-solid slurry to achieve homogenous distribution of the particles followed by casting the blanks in permanent mold. The blanks then undergo a forging process in a closed die.

The research program

The two companies, LIEBHERR and PALBAM agreed on demonstrating products, which are the subject for this research. The demonstrating products are based on an existing product which is now produced by forging of aluminum alloy. The target of this work is to produce a lighter magnesium based product, with the same or better properties.

LIEBHERR is in charge of the definition of the required mechanical and physical properties and the functional tests of the developed products. PALBAM-AMTS deals with the development of the blanks material systems (in cooperation with the Israel Institute of Metals – Technion) based on magnesium alloy matrix reinforced by SiC particles, the development of an adapted forging process and the development of coatings to improve the corrosion resistance of the developed products. The research program is based on 2 years duration (2007-2008). During the first 9 months of the project, the following activities have been carried out:

- The required properties of the demonstrating products have been defined
- 2 series of forging tests with 6 material systems (3 Mg alloys reinforced by 2 different concentrations of SiC particles) have been performed
- Mechanical tests to evaluate the material properties and the effect of forging parameters process on the product have been performed
- Two progress meetings have been held

Based on the first results, further development will be performed to obtain the alloys showing the best mechanical and physical properties. Moreover, to meet the tight schedule of the project, the design of the forging tools was launched.

Framework and funding

The project is run under FIRAD – the France-Israel Industrial R&D Cooperation Framework and has received a EUREKA label no. E!3921.

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