Seminars: Prof. Fernando Audebert

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Seminar 1: June 8, 2012 – 2:00 p.m.

"Amorphous and Nanoquasicrystalline Al-based Alloys: Structure and Phase Transformation Studies"

Seminar 2: July 13, 2012 – 2:00 p.m.

"Nanoquasicrystalline Alloys and Composites: Mechanical Properties and the Challenge of their Industrialization"

The Technology Roadmaps for the Aluminium supply chain, aerospace and automotive industries worldwide are in full agreement in the call for the development of new alloys with a step-change in performance in respect of strength and toughness at ambient and elevated temperatures.

Rapid solidification, severe plastic deformation or composite techniques have been used for many years for achieving Al-based materials with improved mechanical properties. Rapid solidification techniques, such as melt-spinning or gas atomisation followed by consolidation processes lead to obtain Al alloys composed by small Al grain matrix, high solute content and high volume fraction of intermetallic particles. Moreover, those techniques also allowed obtaining hypereutectic Al-Si alloys with high volume fraction of very refined Si particles. Among the Al alloys produced by rapid solidification the NanoQuasicrystalline alloys composed by submicron sized quasicrystalline particles embedded in an fcc-Al matrix have been produced with high strength at elevated temperature.

Different Al based nanoquasicrystalline alloys have been developed in the recent years. Particularly, it was observed the additions of Ti and Nb to the Al-Fe-Cr alloys increase the stability of the quasicrystalline phase delaying the microstructural transformation to higher temperatures. These alloys maintain a high strength at elevated temperatures making them a promising candidate for industrial applications.

In the seminar will be shown the development of bulk Nanoquasicrystalline alloys by means of manufacturing processes scalable up to a near industrial scale. The influence of industrial contamination, microstructure and mechanical properties of the material obtained are compared with the corresponding to the alloys obtained initially by melt-spinning. In addition to the pure nanoquasicrystalline alloys, nanocomposites were obtained by the addition of pure Aluminium particles.

Industrial applications in the automotive and aerospace sectors require the study of different aspects of the mechanical properties therefore tensile, compression and microhardness tests were done at room and elevated temperatures. In addition Hopkinsons bar test measurements at high strain rates were obtained. The results are compared against rapid solidified Al-Si alloys and Al-Alloys SiC nanocomposites produced by ball milling. The combination of properties of each material and possible industrial applications are discussed.