Investigation of the role of non-conventional alloying elements addition in aluminum alloys for automotive applications

Due to stricter and stricter economic and environmental requirements, it is becoming increasingly important to reduce vehicle weight without a decrease in mechanical properties. For this objective, Al-Si-Mg alloys are among the most common aluminum alloys for automotive applications. Indeed, these alloys are characterized by excellent castability, good corrosion resistance, high elongation and high strength, particularly after proper heating treatments.

A further improvement can be achieved through the modification of aluminum alloys by the addition of not conventional alloying elements in order to improve mechanical characteristics while saving material and decreasing the weight of products.

Main topics of research are the definition of optimal parameters for heat treatments, the identification of the precipitation sequence and the study of microstructure and mechanical properties of non-conventional aluminum alloys. This research project is characterised by the close cooperation with a company which produces aluminium wheels with the studied alloys and which is using an innovative process to produce aluminium wheels, called H.A.F. (Hybrid Aluminium Forging).

Furthermore, rheological characterization of the materials will be performed in order to understand how the viscosity can be influenced by temperature and shear rate. Such measurements are believed to be fundamental to optimize any casting process or either software simulation. On the other hand, the rheological behavior of molten metals is a critical subject. In recent years, many reaserchers showed evidences of non-newtonian flow behavior of liquid metals, which were usually considered as newtonian fluids. As it is not clear if this is due to artifacts of the measuring systems or to the actual properties of the material, aluminum alloys will be studied in full liquid conditions with the aim of improve the knowledge about the flow behavior of molten metals.