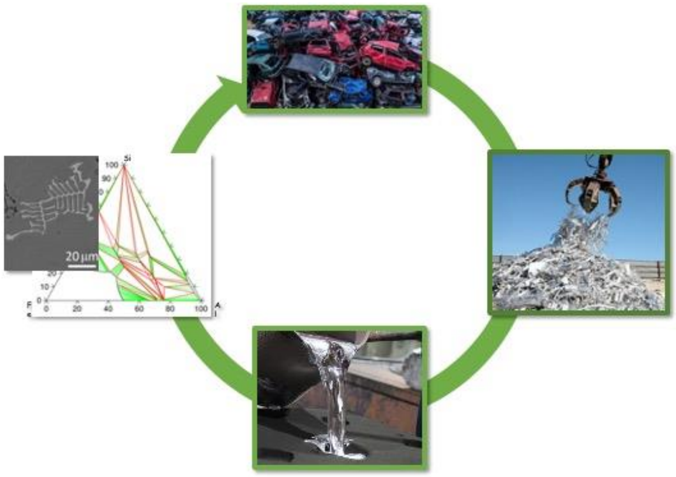
PhD offer [from October 2023]
Science of Dirty Alloys: improving recyclability of Al alloys



Context: Theoretically, aluminum alloys, like most metal alloys, are infinitely recyclable. Moreover, in the case of aluminum, which is a very energy-intensive metal, the energy involved in the recycling process represents only 5% of the energy required for primary production from the ore. Aluminum alloys are classified into two main families: wrought and cast alloys. Wrought alloys are characterized by the highest mechanical properties and by the use of alloying elements (Mg, Si, Mn, Cu) in low concentrations. At the opposite the same elements are also present in casting alloys but in higher concentrations. As most of the alloying elements are almost impossible to remove, wrought alloys can be recycled into casting alloys, but the reverse is practically impossible. Therefore, recycling usually tends to cascade down from wrought alloys to less pure shape casting alloys. Moreover, end-of-life recycling also leads to contamination by ferrous alloys (Fe, Cr, Ni) and a drastic decrease in the properties of the so-called secondary aluminium, in particular its ductility. This decrease is usually attributed to the presence of Fe-rich intermetallic compounds (IMC).

Objective: The objective of the Ph.D. is to study a wide range of aluminium alloys compositions and find a pathway to improve their recyclability *without any cascade down to casting alloys*.

Methods: The microstructure of the alloys, and especially the nature, size, shape and distribution of intermetallic compounds, will be deeply investigated by advanced techniques such as Scanning Electron Microscopy, Energy Dispersive Spectroscopy, Electron BackScattered Diffraction, X-ray tomography, X-ray diffraction and chemical analysis. The influence of several processing parameters such as cooling rate or homogenizing heat treatment will be considered. Experimental results will be compared with numerical phase transformation models. Thermodynamics databases will be optimized in order to improve the predictive capacity of numerical simulation tools.

We are looking for a highly-motivated individual with a Master or Engineer degree in materials physics or material science. An aptitude for experimental work as well as numerical aspects will be appreciated.

Salary: 2135€ gross monthly

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