advanced metallic systems
Centre for Doctoral Training

Crystal Plasticity and Microstructure Modelling for Rolled Aluminium Sheet

Aluminium (Al) alloys belong to the group of light metals. This group is defined as the engineering metals that have low relative densities. But not only their lightweight makes these alloys highly attractive to be used in multiple applications, Al alloys have also an appealing price, a good corrosion resistance and high electrical and thermal conductivity. Especially, these alloys are crucial in the improvement of the transport sector, given that the substitution of the traditional alloys applied in this sector for Al alloys saves fuel and promotes the increase of the range of electric vehicles.

Among the different ways in which the Al alloys can be manufactured, their most popular way of use is in form of sheets. Al sheets are widely employed in many relevant sectors, as they can be cut and formed into different desired shapes. This manufacturing route has many applications; it is employed in packing to manufacture cans and packages, in transportation to make panels for automobile bodies and tractor trailers, in household applications and in construction as sidings, gutters, roofs, awnings and carports, among many others. Therefore, Al sheets are very demanded and the competition to have the best performance of this product is very high in the market. A key challenge is to obtain at the same time high strength, good formability, and corrosion resistance, ideally in an alloy which is highly recyclable and also low cost.

The efforts of this project will be focused on producing high quality Al sheets with better final performance, formability and longer durability by means of the achievement of a connection between their processing and their structural features at a microscopic level. Especially, more attention will be paid in the bending process, where Al sheets tend to suffer failure during forming. As there are many parameters to be optimised, there will be a first step consisting of simulation work, and then experimental work will be carried out to compare the results obtained with the conclusions of the simulation part. Finally, the structure of the alloy will be observed with advanced microscopy to observe the structural features of the optimised material. Therefore, in this project, the structure of Al alloys at a microscopic level will be studied, in particular texture (atomic orientation and distribution) and strengthening precipitates (particles within the Al alloys that help to reach higher values of strength). The project is part of LightForm; a larger activity which includes a focus on producing high performance, highly formable, environmentally sustainable Al sheet.