Doctoral School in Materials, Mechatronics and Systems Engineering

Research subjects proposed for the 39th cycle

Materials Science and Engineering (area A)

- *Reference person:* C. Menapace
Title: Study of the shell-zone segregation in hard Al alloys ingots produced by semicontinuous casting process A9)

The scope of this research, funded by Almec Tech s.r.l., is to investigate the phenomenon of segregation (micro and macro) in the shell zone of “hard” Al ingots (i.e., having a high content of alloying elements) cast through semi-continuous direct chill casting (DCC) process. DCC occupies a prominent position in the commercial processing of aluminum alloys, especially in the production of large ingots. The segregation, or non-uniform chemical composition, is one of the main defects that occur during this process. While micro-segregation can be eliminated through a thermal treatment (homogenization), macro-segregation doesn’t change with it, leading to the formation of permanent defects which require a strict control during the casting process. There are a lot of studies about macro-segregation particularly on low alloyed (soft) alloys, but this phenomenon is currently still not very clear.
The aim of the present research is the analysis of all the variables involved in the formation of segregation in the shell zone of hard DC-cast Al alloys to understand the mechanisms behind it and to reduce it with the use of innovative casting molds. A model will be proposed to describe this phenomenon, that will be tentatively applied also to the electromagnetic direct chill casting (EDCC).