Using Metallurgical Modelling in Process Optimization and Alloy Development in Extrusion of Al-Mg-Si Alloys

Abbas Bahrami*[a], Ali Reza Eivani[b], Maryam Yazdan Mehr[a]

[a] Department of Materials Engineering, Isfahan University of Technology, Isfahan 84156-83111, Iran
[b] School of Metallurgy and Materials Engineering, Iran University of Science and Technology (IUST),
Tehran, Iran

Abstract: In this paper a case study in process optimization and alloy development in extrusion of Al-Mg-Si alloys is presented. Extrusion is a complicated thermomechanical process with large induced strains. During extrusion several metallurgical reactions, including recovery, recrystallization and precipitation can take place, resulting in products with different microstructures and mechanical properties. Controlling and optimization of final microstructure necessitates a proper control of process parameters and alloy chemistries. In many cases this is done using trial and error. However, trial and error obviously needs a lot of investment and there is a chance that the optimum window is missed due to improper selection of experimental parameters. In this paper the systematic way of using modelling in alloy and process optimizations in extrusion of AA6005A is introduced. The modelling strategy is based on the coupling between finite element modelling (FEM), grain growth modelling and precipitation modelling. Results are confirmed and implemented in a real industrial case.

Keywords: Extrusion; Al-Mg-Si Alloys; Optimization; Modelling