Simulating the effect of heating rates on texture evolution in Aluminium alloys

Vitesh Shah*[1], Georg Falkinger[1], and Ramona Tosone[1]

[1]AMAG rolling GmbH – Austria

Abstract

Recrystallization is observed during the annealing of cold or hot-worked aluminium alloys. Recrystallization controls the texture and the grain morphology of the aluminium alloys and is therefore important for controlling the material properties of aluminium alloys. It has been observed that different heating rates during annealing lead to significantly different recrystallization textures. The effect of heating rates on recrystallization texture has been simulated by combining a full-field crystal plasticity model (DAMASK) and a cellular automata model (SCORE). The heating rates affect recrystallization texture through the number of recrystallized nuclei. It has been observed that higher heating rates lead to finer grain size due to higher number of recrystallized nuclei. To capture this heating rate effect, a time and temperature dependent nucleation rate formulation in the cellular automata model has been incorporated. This formulation results in increase in the number of nuclei with increasing heating rates. This affects the texture evolution as well as grain size/morphology evolution during recrystallization. The simulated recrystallized texture is then compared with experimentally observed texture for different industrially relevant heating rates.

Keywords: Aluminium alloys, recrystallization, crystal plasticity, cellular automata, heating rates.

*Speaker