The prediction of texture evolution and plastic anisotropy after asymmetric rolling and annealing of aluminium alloys

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ABSTRACT

Asymmetric rolling followed by annealing has been proposed to replace conventional rolling for aluminium sheets in order to obtain superior deep-drawing properties [1]. So far, strain and texture gradients across the sheet thickness have been largely ignored. A hierarchical multi-scale (HMS) modelling framework [2-4] was used in this work to perform a parametric study of asymmetric rolling employing finite-element simulations and crystal plasticity modelling. This has produced insights in the interactions between the rolling parameters on the one hand, and the deformation textures and their homogeneity across the sheet thickness on the other hand. Subsequently, a recrystallization model [5] has been employed to predict the textures across the thickness after annealing. This model is based on a crystal plasticity estimate of the stored energy of plastic strain. The obtained recrystallization textures are supplied as input to tensile test simulations, again using the HMS framework, for the prediction of Lankford values and deformed specimen shapes as a measure of the plastic anisotropy. The goal of this work is to provide insights for optimizing the final plastic anisotropy of asymmetrically rolled and annealed aluminium sheet.

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