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Effect of Temperature and Deformation Mode on Texture Evolution of AA6061

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Abstract : At molecular or micrometre scale, practically all materials are neither homogeneous nor isotropic. The concept of texture is used to identify the structural features that cause the properties of a material to be anisotropic. For metallic materials, the anisotropy of the mechanical behaviour originates from the crystallographic nature of plastic deformation, and is therefore controlled by the crystallographic texture. Anisotropy in mechanical properties often constitutes a disadvantage in the application of materials, as it is often illustrated by the earing phenomena during drawing. However, advantages may also be attained when considering other properties (e.g. optimization of magnetic behaviour to a specific direction) by controlling texture through thermo-mechanical processing). Nevertheless, in order to have better control over the final properties it is essential to relate texture with materials processing route and subsequently optimise their performance. However, up to date, few studies have been reported about the evolution of texture in 6061 aluminium alloy during warm processing (from room temperature to 250ºC). In present investigation, recrystallized 6061 aluminium alloy samples were subjected to tensile and plane strain compression (PSC) at room and warm temperatures. The gradual change of texture following both deformation modes were measured and discussed. Tensile tests demonstrate the mechanism at low strain while PSC does the same at high strain and eventually simulate the condition of rolling. Cube dominated texture of the initial rolled and recrystallized AA6061 sheets were replaced by domination of S and R components after PSC at room temperature, warm temperature (250ºC) though did not reflect any noticeable deviation from room temperature observation. It was also noticed that temperature has no significant effect on the evolution of grain morphology during PSC. The band contrast map revealed that after 30% deformation the substructure inside the grain is mainly made of series of parallel bands. A tendency for decrease of Cube and increase of Goss was noticed after tensile deformation compared to as-received material. Like PSC, texture does not change after deformation at warm temperature though. n-fibre was noticed for all the three textures from Goss to Cube.

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