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Experimental study of mechanical properties and formability of ultrafine-grain sheet aluminium alloy 5083

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Abstract: The equal channel angular rolling (ECAR) process is one of the methods of severe plastic deformation (SPD) that is considered to obtain ultrafine-grain materials (UFG). In this process, thin metal sheets, without changing the dimensions, will be subjected to shear strain through the channels of a die set. In this paper, the effect of the ECAR process on the mechanical properties of aluminum alloy 5083 (AA5083) is investigated. In this research, the mechanical properties and formability of the samples were measured at ambient temperature by performing three passes of the ECAR process. The results of hardness and the tensile test showed that, by performing the ECAR process up to three passes, the hardness and yield strength of samples increased by 52% and 76%, respectively. Furthermore, the forming limit diagrams were determined experimentally, using the Nakazima test. The obtained results show that after the third pass, the forming limit diagrams' level moves downward, meaning that a reduction occurred in the forming limits of equal channel angular rolled samples.

Keywords: Equal channel angular rolling (ECAR); Severe plastic deformation (SPD); Aluminium alloy (AA) 5083; Mechanical properties; Forming limit diagram (FLD).