Interface Shear Strain of 1050/6061 Laminated Composite Processed by Asymmetric Accumulative Roll Bonding

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Abstract. Accumulative roll bonding (ARB) is one of the severe plastic deformation methods of producing ultrafine grained laminated metal composites (LMCs). This paper is focused on LMCs consisting of dissimilar bimetal system of aluminum alloys AA1050/AA6061. One difficulty of roll bonding two dissimilar materials is obtaining of elevated strain at the interface of the composite in order to provide the ultrafine grain structure and superior bonding strength between the stacked layers. Compared to conventional ARB the asymmetric accumulative roll bonding is more appropriate for the production of dissimilar bimetal composites. This paper presents the results of the finite element simulation and comparison of interface shear strain behavior during symmetric and asymmetric ARB of AA1050/AA6061 bimetal composites. Influence of rolls speed ratio, contact friction and layer thicknesses on strain distribution through composite thickness, especially on interface between the AA1050 and AA6061 layers, during asymmetric ARB were analysed by FEM in details. It was numerically shown that the strain in soft material (AA1050) of the interface can be extremely increased while the strain in hard material (AA6061) remains almost unchanged. Since the strain at the interface can be seriously increased, than the ultrafine grain size and the superior bonding strength between the stacked layers are expected during asymmetric ARB. The FEM results of investigation of the influence of the rolls speed ratio and friction conditions on strain distribution through composite thickness, especially on interface between the AA1050 and AA6061 layers, can be useful for the development of the improved ARB process of AA1050/AA6061 bimetal composites with UFG structure and high bond strength.