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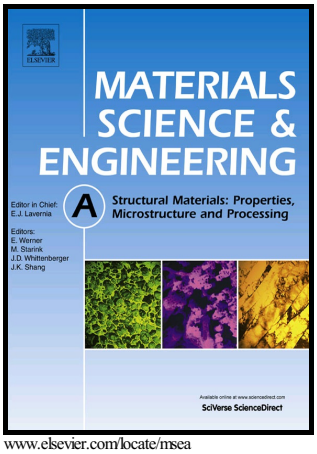

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Fracture toughness investigation of Al1050/Cu/MgAZ31ZB multi-layered composite produced by accumulative roll bonding process

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Abstract

In this article, fracture behavior of multi-layered composite processed via accumulative roll bonding (ARB) method has been investigated. At first, Al1050/Cu/MgAZ31B multi-layered composite has been prepared by ARB through seven passes. The microstructure and mechanical properties have been evaluated using uniaxial tensile test, microhardness test and optical microscope, respectively. Then, the plane stress fracture toughness of Al1050/Cu/MgAZ31B have been studied via R-curves. Also, tensile fracture surfaces have been demonstrated by scanning electron microscope (SEM). The results of microstructure investigations have indicated that plastic instability occurred for both pure Cu and Mg AZ31B reinforcing at the primary sandwich and uniform distribution has been processed. By increasing the applied strain, the values of microhardness for the three layers Al1050, pure Cu, and Mg AZ31B as well as ultimate tensile strength (UTS) have been significantly increased, continully, and UTS has reached to the maximum value of 355.5 MPa. SEM images of the tensile rupture surfaces in the different ARB passes have demonstrated that with increasing the applied strain, the fracture mode converted to shear ductile at the last ARB pass. Results of fracture test have shown that by increasing the applied strain, the value of fracture toughness have been raised, continually and at the third pass reached to the maximum value of 40.4 $MPam^{1/2}$. Also, the trends of fracture toughness for Al1050/Cu/MgAZ31B were in great matching with the conclusions of the fracture behavior investigation of Al1050 produced by ARB.

Keywords: Al1050/Cu/MgAZ31B multi-layered composite, Accumulative roll bonding (ARB) process, Fracture behavior, Mechanical properties, Microstructure.