IN SITU STRESS MEASUREMENT OF BIAXIALLY STRAINED AA5754-O

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Predictions of sheet metal forming operations are typically determined using finite element analyses (FEAs), but these analyses require calibrated constitutive laws through a large range of plastic strain. Often there is a lack of true multiaxial stress-strain data. Typical biaxial tension experiments require various assumptions or FEAs to determine the stresses in the material during testing. A method of *in situ* near surface backscatter (high 2θ angle) low power (60W) X-ray diffraction (XRD) is used to measure lattice strains during biaxial straining, and stresses are calculated through the $\sin^2\psi$ method. The method permits measurement of stress at an arbitrary number of pause times during loading (while under load) at plastic strains (measured macroscopically by an extensometer) up to failure. Currently, space and system constraints limit the ψ angles to a small range (+/- 30 degrees) and only one reflection plane can be used at a time However, the results for the first data set (for aluminum alloy 5754-O) seem promising. Results are presented for uniaxial, plane strain and balanced biaxial strain states. Special attention is given to the determination of XECs (by uniaxial deformation of as received and equi-biaxial prestrained samples), and the potential effects of intergranular stresses and texture evolution (measured through *ex situ* XRD analysis of various biaxial prestrained samples).