Determination of Residual Stress by Neutron Diffraction Analysis

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1 Abstract

2 Introduction and Background

2.1 Diffraction

3 Experimental Details

3.1 Testing of Mechanical Properties

In order to determine the residual stress in a material by the neutron diffraction method, it is critical to know some of the important mechanical properties of the material. Namely: the Young's Modulus (E), and Poisson's Ratio (ν). The Young's Modulus (or Modulus of Elasticity) is the relationship between stress (σ) and strain (ϵ).

$$\sigma = E\epsilon$$

Poisson's Ratio is used for stress and strain in three dimensions:

The mechanical properties of the materials were determinedby the use of the University's tensile testing facilities on small samples of each material. The samples used were small 'dogbone' coupons, cut from the original stock plates of aluminium. A schematic of these 'dogbones' is shown below.

These coupons wer put through a standard tensile test, involving the application of an increasing tensile load until failure while simultaneously recording measurements with a load cell and a strain gauge. Once the sample had passed passed it's yield stress and begun plastic deformation the strain gauge was remooved the and load was increased to the point of failure. The final load (F_F), and ultimate strain (σ_U) are recorded below in 1.

Table 1: Final load and ultimate strain measured for the tensile test coupons

Sample	F_F (MPa)	σ_U
6061-T6	18.1	0.2
7075-T6	34.7	0.18

4 Results

5 Discussion

6 Conclusion

7 References