UC DAVIS Chemical Engineering & Materials Science

EMS-162L: Structure and Characterization of Materials Laboratory

Winter Quarter, 2004

Residual Stress Analysis

1. What is residual stress?

2. Calculate and plot the) d and) 22 versus $\sin^2$R data for a steel specimen for which a residual stress of -500 MPa had been measured using a diffractometer. The details of the analysis and essential material constants are: $8_{Cr"}$=0.229092 nm, -45°#R#45° in a total of 11 steps spaced evenly in terms of $\sin^2$R, Young's modulus=209 GPa, <=0.28 and the analysis was based on a scan of the (211) peak. (Hints – use the PDF file for iron for the reference diffraction data for steel and use a spreadsheet to do the calculations.)

3. When calibrating and aligning a powder diffractometer most people strive to keep the peak position error to less that 0.01° 22. Compare this to the typical peak position shift measured when using the $\sin^2$R method of residual stress measurement.

4. Would you expect to measure tensile or compressive residual biaxial stresses in the inside surface of a bend radius? Outside surface of the bend radius?