ISIS Experimental Report		RB Number:	13990
Rutherford Appleton Laboratory		Date of Report:	17.10.2003
Title of Experiment:	Effect of Near Surface Residual Stresses on performance of Cermet coatings	Local Contact:	Dr Mark Daymond
Principal Proposer: Affiliation:	Dr Rehan Ahmed Heriot-Watt University, Edinburgh, UK	Instrument:	ENGIN-X
Experimental Team:	R. Ahmed, L. Edwards, M. Daymond, S. Stewart, V. Stoica	Date of Experimer	nt: 21.07.2003

**EXPERIMENT SUMMARY** This experiment, first of its kind in published literature on cermet overlay coatings, was a complete success in achieving its objectives. Two thicknesses (1mm and 0.4mm) of coatings were successfully measured for microstrain in vertical scan mode, whereas the 1mm thick coating was also measured using the horizontal scan. The following is a summary of milestones achieved:

- 1) Comparison of neutron diffraction and x-ray diffraction results for future modelling.
- 2) Influence of coating thickness and HIPing post-treatment on microstrain.
- Proof that the technique can be applied (with some adjustments) to measure the strain in finished (sprayed) components.

Figures 1 and 2 provide a brief summary of the test results recorded during the three days experiment at ISIS. Prior to this experiment, thermal spray coatings (WC-12%Co) were sprayed in the two different thicknesses by Fujimi, Inc. Japan, some of which were subsequently post-treated (Hot Isostatically Pressed (HIPed)) using facilities at Bodycote, UK.

**FUTURE PLANS** There is an ever-greater need to further explore the full potential of application of neutron diffraction technology in thermal spray coatings. Future targets to consolidate the existing results and attract potential collaborators for full EPSRC proposal include:

- 1) Measurement in thinner (100 micron) coatings.
- Application of technique to more complex cermets to provide confidence e.g. WC-NiCrBSi coatings
- Investigate changes in coating bonding mechanisms from mechanical interlock to metallurgical bonding after post-treatment using diffraction patterns.



**Figure 1**, Vertical and Horizontal scan results indicating microstrain in 1mm thick WC-Co coating deposited by JP5000 (HVOF) spraying on 3mm thick AISI 440C steel substrate.



Depth from coating surface (Log scale)

**Figure 2**, Vertical scan results comparing microstrain in 0.4mm thick WC-Co coatings in as-sprayed and HIPed at 1200°C conditions. Coatings deposited by JP5000 (HVOF) spraying on 8mm thick AISI 440C steel substrate.

**DISSEMINATION of RESULTS** A full journal publication is planned by the investigators to present this work. The results will also be presented at open international conferences for wider dissemination of results.