Contribution ID: **246** Type: **not specified**

RESIDUAL STRESS ESTIMATION IN COATING TECHNOLOGY

Tuesday, 19 November 2024 11:30 (30 minutes)

Non-destructive determination of residual stresses in the WC-Co coated systems was exceptionally challenging in that the coatings were only 200 microns thick. The best suited techniques for investigation of WC were diffraction-based strain scanning using penetrating radiation such as thermal neutrons (most penetrating), high energy synchrotron X-rays (100 keV enables 20 micron penetration) and laboratory X-rays (limited to 5 micron penetration). Laboratory X-rays (Necsa, using Co radiation), thermal neutrons (ANSTO, Australia) and X-ray synchrotron (ESRF, France) were successfully employed to resolve the stress conditions. The influences of heat treatment were assessed by stress relief heat treatment of the grit-blasted substrates and coated substrates.

It has been determined that the surface stresses of the coatings exhibited both small compressive and low tensile stresses on the as-sprayed coated samples. After annealing, the stresses became substantially more compressive. The near-surface trends of the grit-blasted substrates were completely relaxed after annealing, with thermal stresses being the dominant mechanism for residual stress induced due to the large difference in the coefficients of thermal expansion (CTE) between the WC coatings and the substrates.

Keyword: X-ray diffraction, Synchrotron XRD, Neutron diffraction, WC-Co coating, HVOF

References:

1. O.P. Oladijo, PhD Thesis, University of the Witwatersrand, 2013.

2. O.P. Oladijo, A.M. Venter, et al, X-ray Diffraction Measurement of Residual Stress in WC-Co Thermally Sprayed Coating onto Metal Substrates, Surface Coating Technology, 206(23) (2012) 4725-4729.

3. A.M. Venter, T. Pirlin, T. Buslap, O.P. Oladijo, et al, Systematic Investigation of Residual Strains Associated with WC-Co Coatings Thermal Sprayed onto Metal Substrate, Surface Coating Technology, 206(19-20) (2012) 4011-4020.

4. A.M. Venter, O.P. Oladijo, et al, Performance Characterisation of Metallic Substrates Coated by HVOF WC-Co, Thin Solid Films, 549 (2013) 330-339.

Primary authors: OLADIJO, Philip Oluseyi (Botswana International University of Science and Technology); Prof. CORNISH, L.A. (University of the Witwatersrand, South Africa)

Presenter: OLADIJO, Philip Oluseyi (Botswana International University of Science and Technology)

Session Classification: Plenary

Track Classification: AfLS