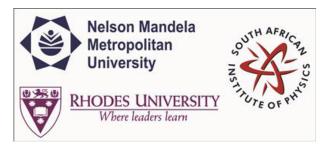
SAIP2015



Contribution ID: 291

Type: Oral Presentation

X-ray diffraction and Raman spectroscopy based residual stress measurements for assessment of fatigue in leached polycrystalline diamond tool bits

Tuesday, 30 June 2015 15:20 (20 minutes)

Abstract content
 (Max 300 words)
Formatting &
Special chars

Polycrystalline diamond (PCD) cylindrical tool-bits are complex materials systems. One aspect that has a significant influence on the in¬-service behaviour and lifetime is the residual macro-stress state created as a result of the difference in coefficients of thermal expansion (CTE) between the diamond table and the WC-Co substrate. Leached PCD, where the near-surface cobalt has been removed from the PCD layer, has a longer inservice lifetime and the reasons for this are not well understood. The measurement and study of the average inplane stress fields on the surface of the PCD thus becomes crucial in understanding the in-service behaviour with the quest to have an extended life for the tool-bits. Two complementary non-destructive techniques namely Raman spectroscopy and X-ray diffraction have been employed for residual stress measurements on detached PCD layer samples of 16 mm in diameter and 2 mm in thickness. The Raman peak reveals both the nature and magnitude of the stress present in the material but it is essentially a surface technique with the depth penetration of the visible light being limited by the transparency of the PCD to only a few microns. The X-ray Diffraction technique probes the change in the spacing of the atomic planes of the diamond crystals with strain and has a larger penetration depth. Employing the ball on three balls fatigue set-up the samples were cyclically loaded under constant amplitude load control at a frequency of 10 Hz at room temperature and pressure conditions. Raman and XRD residual stress measurement were done as a function of the number of fatigue cycles to study the surface and near-surface stress under increasingly severe fatigue conditions. These are compared with published Raman spectroscopy results on unleached PCD.

Apply to be
 considered for a student
 award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
 PhD, N/A)?

PhD

Main supervisor (name and email)
and his / her institution

Dr Rudolph Erasmus Rudolph.Erasmus@wits.ac.za School of Physics University of the Witwatersrand

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

No

Please indicate whether
this abstract may be
published online
(Yes / No)

Yes

Primary author: Mr VHARETA, Maxwell (DST/NRF Centre of Excellence in Strong Materials, University of the Witwatersrand)

Co-authors: Prof. COMINS, Darrell (University of the Witwatersrand); Dr ERASMUS, Rudolph (University of the Witwatersrand)

Presenter: Mr VHARETA, Maxwell (DST/NRF Centre of Excellence in Strong Materials, University of the Witwatersrand)

Session Classification: Applied

Track Classification: Track F - Applied Physics