Birefringence Analysis of Diamond Utilising the MetriPol System

D. HOWELL[1], A.P. JONES[1], D.P. DOBSON[1], H.J. MILLEDGE[1], AND J.W. HARRIS[2]

[1] Department of Earth Sciences, University College London; daniel.howell@ucl.ac.uk; adrian.jones@ucl.ac.uk; d.dobson@ucl.ac.uk; j.milledge@ucl.ac.uk

[2] Department of Geographical & Earth Sciences, University of Glasgow; j.harris@earthsci.gla.ac.uk

Birefringence has long been recognised in diamond as an anomalous optical property for a cubic mineral [1]. Various causes have been postulated for this phenomenon but they all identify birefringence as being the result of the photoelastic effect (change of refractive index with stress) [2]. Until now birefringence studies (a non-destructive analytical technique) has not been ultilised because of the time-consuming and inaccurate nature of the analysis. The MetriPol is a new automated birefringence analysis system that can produce very accurate data in a matter of seconds [3].

The MetriPol system is being utilised in an experimental investigation to re-evaluate the photoelastic constants for diamond. These constants are fundamental in relating stress and strain to the resultant birefringence. Data generated from this birefringence analysis can easily be manipulated to calculate the stress and strain within a diamond.

Optical studies of mineral inclusions have often reported the occurrence of strain birefringence in the surrounding diamond, and X-ray and Raman investigations of such inclusions have shown that some can remain under relatively high residual pressures after their transportation to the surface [e.g. 4]. We report quantitative birefringence analysis of such strain features and their implication concerning the P & T conditions of entrapment, assuming no subsequent strain release has occurred. This birefringence data is being compared with analyses using the above techniques, as well as finite element analysis modelling, to test the validity of the results.

References

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