Residual pressure differences between diamond crystals and their guest inclusions

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Several diamonds with mineral inclusions were selected for in situ microanalysis of pressure relations. The inclusions show a wide variety of morphological shapes, i.e. cubo-octahedral morphology, tabular and flattened parallel to octahedral plane of diamond hosts, which is irrespective of their crystal systems and they have no visible fractures reaching into the diamonds. Non-destructive Raman in situ point-by-point mappings were done in confocal mode. The residual pressure can be estimate at room temperature by the shift of the first-order Raman spectrum band of diamond ~1332 cm^{-1} (Barron et al., 2008; Izraeli et al., 1999; Nasdala et al., 2003, 2005). A colour-coded image, showing the two-dimensional distribution of a certain spectral parameter (here: Raman shift of the main Raman band of diamond) can then be generated from a complete data set of Raman spectra obtained across the actual diamond-inclusion couple (Figure 1). The relative remnant pressures in the investigated diamonds derived from the shift of first-order Raman band of diamond bear 13323 cm^{-1} are approximately from 0.4 to 0.9 GPa around chrome-pyrope inclusions, from 0.6 to 2.0 GPa around chrome-diopside inclusions, from 0.3 to 1.2 GPa around olivine inclusions, from 0.2 to 1.0 GPa around chromite inclusions, and 0.5 GPa around graphite inclusion, respectively.
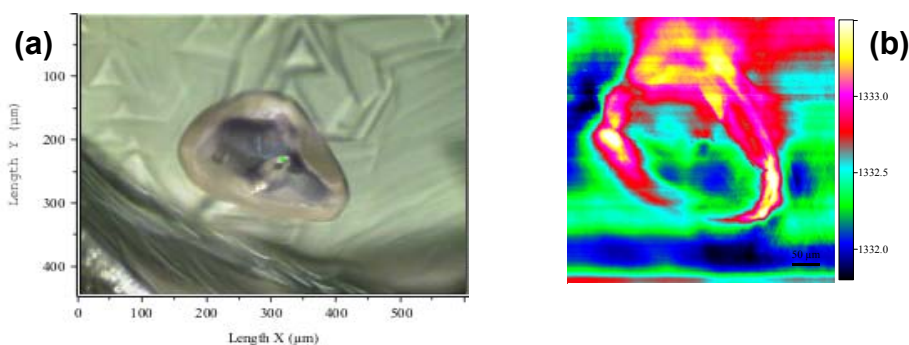

Fig. 1. *(a) Chrome-pyrope crystal inclusion in diamond DHU2.1, transmitted plane-polarised light. (b) Raman map of diamond DHU2.1 [view through the diamond (111) face] around the chrome-pyrope inclusion. The colour-code represents the shift of the first-order Raman band of diamond. The relative pressure between diamond and chrome-pyrope inclusion is 0.9 GPa.*

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