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Characterisation of polycrystalline diamond samples from different origins

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Abstract content
   (Max 300 words)

Diamond is an allotrope of carbon in which the carbon atoms are arranged in specific lattice symmetries, the cubic one with tetravalent covalent bonds being the one most common in nature. Our research interest is in the characterization of the residual stresses locked in polycrystalline diamonds from different sources as a tool to constrain their still very controversial origin.
The typical, primary requirements for natural diamond formation are combinations of High Pressures (HP) and high temperatures (HT). Possible mechanisms of formation are:

1.Igneous crystallisation from C-rich kimberlite melts in the mantle [HT-HP].
2.Solid state conversion from graphite as a result of subduction of oceanic/continental crust to mantle depth [HP-HT].
3.Shock-metamorphism in meteorite impact processes [Ultra HT-PT].
4.Pre-solar.

Examples of the first three mechanisms have been extensively researched, whilst the nature of the pre-solar mechanism is still much debated.

The samples of our investigation are thought to originate from either of the first three mechanisms and include: ballas, 3-12.5mm diameter spherules which are single phased (few inclusions) and are recovered from kimberlites, and carbonados, few mm to cm size pebbles from soils/sediments, that contain inclusions of other phases and may have been formed from any of the above mechanisms. Two carbonado samples with distinctly different shapes, surface colour and morphologies, originating from Brazil and North Africa respectively, are investigated. A non-destructive approach is followed for the residual stress analysis by using laboratory-based X-ray diffraction. Results show the presence of compressive stresses in both the Brazilian and North African samples respectively. However, the ballas could not be studied by XRD due to the coarse grained nature of their diamond grains. SEM imaging and elemental composition analyses (EDS) of the carbonados show impurities and cracks that may be responsible for the observed variations in the stress results.

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Yes

Level for award
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MSc

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

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