The 509th Geodynamics Seminar

# Trial to realize semiconducting diamond using high pressure and high temperature technique


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Recent progress of our trial to realize semi-conducting diamond using high-pressure and high-temperature technique are reviewed in the seminar.

For the applications of diamond to electronic devices, control of carriers by doping is essential. To obtain n-type conductivity in diamond, we tried to introduce phosphorous (P) into nano-polycrystalline diamond (NPD) or single-crystalline diamond grown by chemical vapor deposition (CVD).

First, we attempted to synthesize the NPD using high pressure and high temperature technique, encapsulating P-containing alloy InP with the start material graphite. As a result, the diamond was found to contain In and P constituent .

Secondly, combining the well-developed ion implantation with high pressure and high temperature (HPHT) treatment, we obtained diamond including P elements with their concentration at doping regime. The ion implantation was found to annihilate syngle crystalline structure of CVD-grown diamond, converting the ion-implanted diamond surface to be amorphous. The subsequent HPHT treatment induces re-crystallization of the amorphous phase, concomitantly occurring epitaxial growth. The epitaxial growth provides characteristic crystallographic structure in the diamond surface, e. g., pyramidal structure and very-pure single crystalline diamond formation. Through the optimization of ion implantation condition, we recently obtained diamond having dominant P impurity concentration.



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