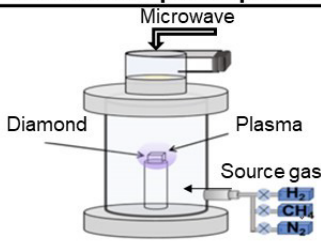
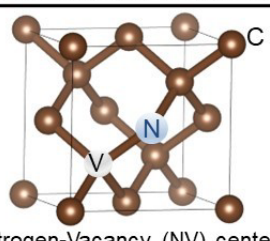


<Research Topics>

Chemical Vapor Deposition of Diamond with Quantum Sensor

ICYS Research Fellow Dr. Takeyuki TSUJI

Chemical Vapor Deposition of Diamond with Quantum Sensor	
Chemical vapor deposition	Quantum sensor in diamond
 Target High quality & large-scale diamond substrate for electronic and quantum devices	 Nitrogen-Vacancy (NV) center

Takeyuki Tsuji



Japan

Development of high quality & large-scale diamond substrate for electronic and quantum devices using chemical vapor deposition and quantum sensors.

■ Research

Diamond is a promising material that can be used for power semiconductors and quantum devices. For example, the band gap, electron mobility, and thermal conductivity of diamond is 5.47 eV, 2200 cm²/Vs, and 20 W/(cmK), respectively, which are higher than those of Si (1.1 eV, 1400 cm²/Vs, 1.5 W/(cmK)). On the other hand, NV centers, which are nitrogen vacancy defects in diamond, are expected to be used as quantum sensors sensitive to magnetic and electric fields, temperature, and pressure, while SiV, GeV, and SnV, which are group IV color centers, are expected to be used as single photon sources for quantum networks.

The challenges of diamond materials are small size of diamond wafers. Although it is useful to synthesize diamond by the CVD method using a substrate synthesized the high pressure and high temperature (HPHT) method, the large area of diamond has not been realized due to the strain and other defects that occur throughout the diamond. Therefore, it is necessary to search for a new CVD growth method that reduces the strain and defects in the entire diamond. Another major challenge is the high dislocation density. The distortion of the diamond lattice around dislocations deteriorates the performance of power semiconductors and quantum devices. Therefore, it is important to clarify the growth direction and formation mechanism of dislocations in CVD diamond films.

The Nitrogen-vacancy (NV) center in diamond mentioned above can be act as a sensor to detect stresses and defects in diamond with high sensitivity. In this study, we aim to develop a new diamond synthesis technology using the sensing technique with NV centers for the purpose of large volume and low dislocation density of diamond substrate.

■ Comments

I am honoured to be an ICYS researcher. ICYS has many talented researchers from various countries. Therefore, I expect that people from many backgrounds will be able to interact with each other and achieve better research results at ICYS.

■ Link

<https://www.nims.go.jp/icys/research/>