총회초청 1

Production of Diamond Below 100℃
- By Plasma CVD Technique-

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Diamond is known to be a thermodynamically stable phase of carbon crystals under both high temperature(-2000℃) and high pressure (-50000 almospheric pressure).

So at lower temperature and lower pressure, C atoms crystalize asgraphite as graphite. However, in these 10 years, one has recogniged that diamond can be produced at about 1000℃ and 0.1 atmosperic pressure by several CVD techniques crucially assisted by the presence of atomic hydrogen in the carbon containing material gas.

In my talk, recent progress on very low temperature deposition of diamond below 100℃ by plasma CVD technique with magnetic field developed in the author's laboratory is introduced.

Then, the mechanism is explanined why such surprizingly low temperature production of diamond is possible.

The low-index [110] crystal axis of silicon was determined by Rutherford backscattering. The yield of the Si-$KL_{23}L_{23}$ Auger electrons was measured as a function of the incidence angle Φ about the [110] axis thereafter. The correlation coefficient C was determined by comparison of the minimum Auger electron yield Y_{min} (= Y_{cha} / Y_{ran}) with the results of computer simulations. In computer program, the trajectories of incident particles and their reactions (Auger electron emission) with lattice atoms are simulated. The degree of correlation in the lattice motion is modulated by the correlation coefficient C which is inserted in computer program as parameter. Within the region between C=0.0 and C=0.6, the minimum yield is a nonsensitive measure for the correlation. However, the dependence becomes strong for C>0.6.

Auger electron yield profiles were measured at room temperature and at high temperatures (T = 670K and 870K). At room temperature, 2.14 MeV $^4He^+$, 1.14 MeV $^4He^+$ and 0.64 MeV H^+ projectiles were used. The value of the vibrational correlation coefficient of 0.5 MeV H^+ measurements at room temperature agrees well with those of high energetic projectiles as expected. Within the temperature region studied, no significant dependence between the vibrational correlation coefficient and the crystal temperature can be found.

Consequently, the correlation coefficient of the normal displacement of nearest-neighbor silicon atoms along [110] at room temperature is determined to be C=0.90±0.02. It is obviously greater than the expected value in theoretical calculations.

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