



Synthesis of new functional carbon films

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● Research Outline

New carbon films

The semiconductor technology has been developed using silicon materials. Carbon that belongs to group IV on the periodic table as well as silicon could not apply to semiconductor devices so much. The allotropes of carbon can form graphite, diamond, fullerene, nanotube. The graphite is an electric conductor, and fullerene and diamond are a semiconductor. We expect carbon materials having various properties will be applied to electronic devices.

(1) We prepare the carbon system films such as diamonds using microwave plasma CVD (fig.1) . It could be applied to the device for use with temperature because of high thermal conductivity.

(2) We also prepare a carbon nitride compound using simple synthesis method. In particular, graphitic carbon nitride ($g\text{-C}_3\text{N}_4$) consists of two-dimensional sheets of carbon and nitrogen atoms as shown in fig.2 . Films of $g\text{-C}_3\text{N}_4$ are prepared by evaporating guanidine carbonate. the optical energy gaps are calculated to be 2.8 eV. Band intensity increases with increasing substrate temperature, but the energetic band position does not shift (Fig.3). The photocurrent of $g\text{-C}_3\text{N}_4$ films can be observed by irradiation with monochromatic light. While the photosensitivity spectra are in almost complete correspondence with the optical absorption spectra, it is also found that the photocurrent is generated by irradiation at photon energies below the optical energy.

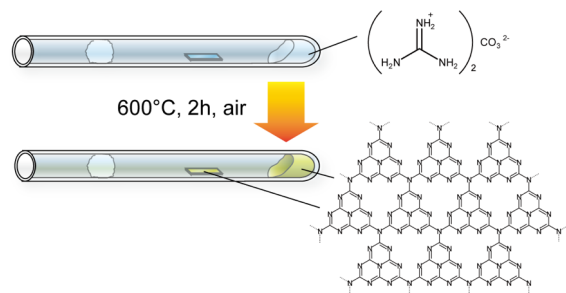


Fig. 2 synthesis of $g\text{-C}_3\text{N}_4$ film

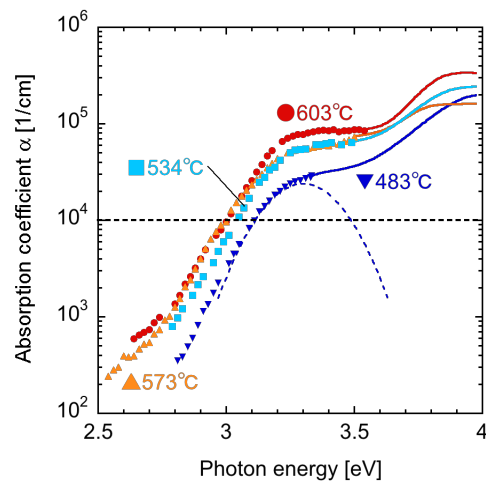


Fig. 3 optical absorption spectra of $g\text{-C}_3\text{N}_4$ films

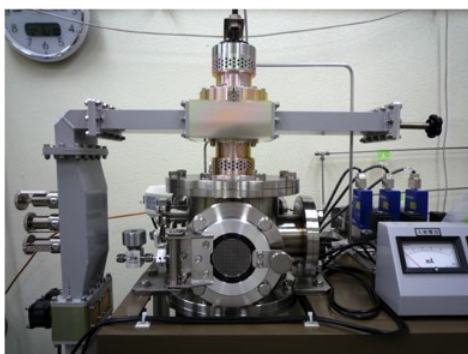


Fig.1 Mircowave plasma CVD

Measuring technique of optical absorption spectrum

In my laboratory, optical absorption spectra of films can be measured by constant photocurrent method (CPM) and photothermal deflection spectroscopy (PDS) . We study the band tail and localized states blow optical gap of samples.