

# MITSUDA LAB.

## Fabrication of carbon allotropes films diamond and amorphous carbon

International Research Centre for Sustainable Materials

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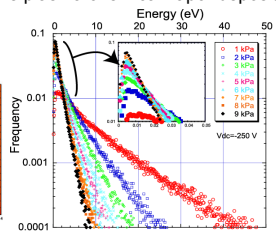
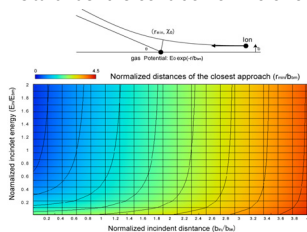
Inorganic Plasma Syntheses

Department of  
Materials  
Engineering

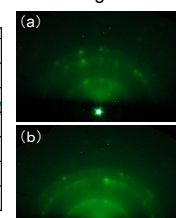
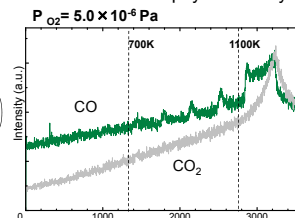
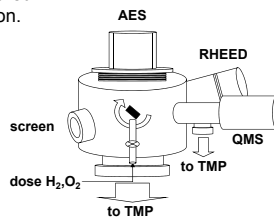
### CVD Growth of Diamond

#### Nucleation and surface chemistry of diamond

Nucleation of diamond from the vapor phase is enhanced by applying negative bias to the substrate. To investigate the physics of this nucleation enhancement, ion energy distribution was simulated on the basis of scattering phenomena of H<sup>+</sup> in the plasma sheath. H<sup>+</sup> ion flux was measured *in situ* under the condition of microwave plasma chemical vapor deposition.



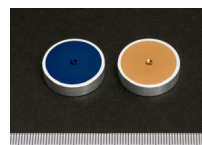
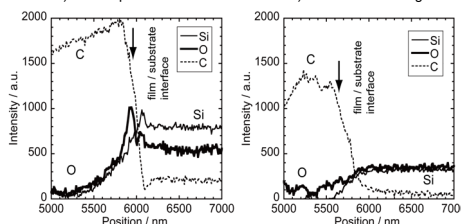
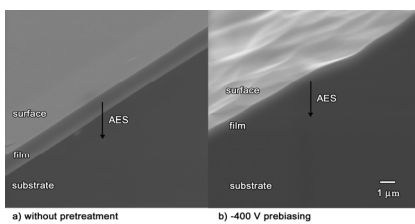
Diamond surface can be chemically terminated by hydrogen or oxygen atoms. We studied the characters of the chemical bonds, the structures and thermal stabilities of the terminations. The mechanism of diamond growth from the vapor phase will be established based on these basic chemical and physical analyses in ultra high vacuum.



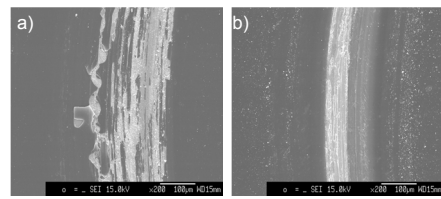
### Fabrication of Diamond-like-Carbon Film (DLC)

#### Improvement of Adhesion Strength & Tribological Behavior

DLC is an amorphous carbon film applied for surface finishing of cutting tools and PET bottles. We are interested in the deposition of the DLC on an Al alloy, which can be used as sliding parts with light weights. It is widely known that the adhesion between the DLC and Al is weak because of the low reactivity between Al and C. In this study, the adhesion strength was improved by controlling the chemical states and structures at the interface between them.



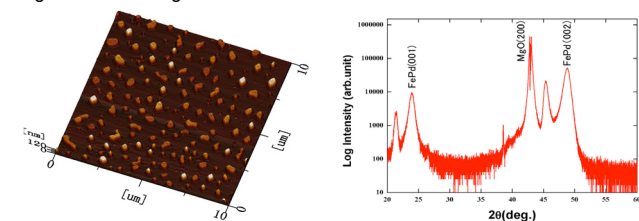
Al alloy machine components coated by the DLC films. The different colors are originated from the interference based on the film thickness, indicating the optical transparency of the DLC.



### Self-assembled nanostructures

#### Driving by Surface Energy

Thin films with self-assembled nanostructures are formed by a bottom-up process based on the sputtering. These structures are applicable for the magnetic data storage devices.

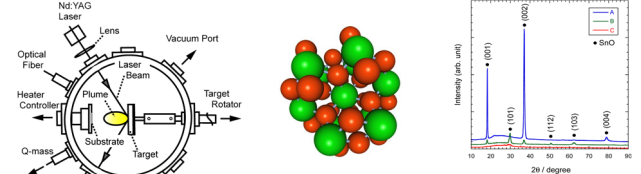


FePd nanodots with diameters of a few tens of nm were formed through the deposition of Fe seeding layer and Au agglomeration layer on a single crystalline MgO substrate. AFM image and X-ray diffraction pattern show oriented crystals and an uniform size of the FePd dots.

### Transparent conductive films

#### Oxide film deposited by Pulse Laser deposition

Transparent and conductive oxide (TCO) films are essential for flat panel displays and solar cells. We are trying to realize a novel TCO with high electrical conductivity based on SnO and SnO<sub>2</sub>.



New candidate elements for the impurity doping are explored by a model simulation. Oriented crystalline of SnO films were achieved on a glass by controlling oxygen and Sn flux during the film deposition.