Physics Colloquium
Michigan Technological University

May 8 (Monday) 2006, 3:00 to 4:00 pm
Room 214, Rekhi Hall (** new location**)

Current Research Activity at the Research Center for Advanced Carbon Materials

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I would like to introduce the current research activity at the Research Center for Advanced Carbon Materials, AIST. Our research outline is as follows. The nanospace in advanced nanoscale carbon materials, as represented by carbon nanotubes (CNT), have unique structures and functions not found in other materials. The objectives of the Research Center for Advanced Carbon Materials are to clarify the ultimate physical properties of carbon and construct a science of nanospace created by carbon materials, and on this basis, to develop environmental/energy-related materials and information technology (IT) materials using the distinctive features of environment-friendly carbon materials. To this end, we are working to clarify the potential for the development and industrialization of carbon materials utilizing nanospaces, establish the position of carbon as basic material for the 21st century in Japan using CNT and other advanced carbon materials, and realize outcomes through corporation with industry, aiming at practical application.
I would like to talk the topics of “Super Growth of SWCNT”, “High Resolution TEM Measurement”, “Novel Polyhedral Graphite” and “DLC/PLC film” etc.

Ultra-low Temperature Nano-diamond Coatings on Large Area Substrates

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We have developed low temperature and large area nano-diamond coating methods using microwave plasma assisted chemical vapor deposition. For the industrial application of nano-diamond coatings large-area and low-temperature deposition techniques are some of key technologies.
We have adopted the surface wave plasma to improve the uniformity of the plasma. Relatively low-gas pressure around 100Pa has been used to avoid the heating of the substrate by the plasma. From these features homogeneous plasma over a 30cm x 30cm area and the substrate temperature of less than 100degC were successfully obtained. We applied hydrogen and methane plasma for our nano-diamond coatings, which is conventional gas mixture for the diamond CVD growth. CO2 was also added in the gas mixture to improve the film quality.
Many kinds of substrate materials have been tested for the coating. The substrates such as iron, aluminum, copper, on which diamond coatings have been very difficult, were successfully coated using this method, as well as silicon, glass.
Our nano-diamond films show high electrical resistance, and relatively high thermal conductivity. Optical applications are expected from the properties, such as transparent for the visible light, high refractive index and small double refraction. The adhesion was especially good for the glass substrate. The coating film protects the glass surface from the scratching by the sandpapers of #400.