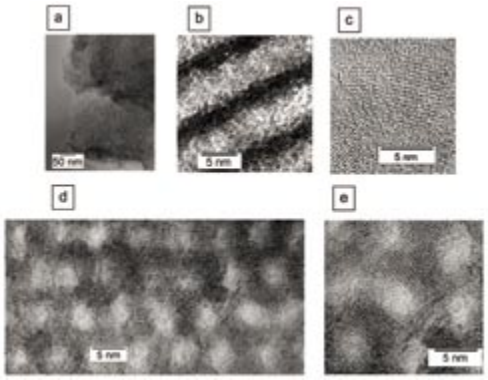
Synthesis of Self-ordered Nanoporous Crystalline Metal Oxide Materials

- Utilization of crystalline phase opens the way to upgrading energy devices, photocatalyst devices, etc -

Haoshen ZHOU
Energy Technology Research Institute
e-mail: hs.zhou@aist.go.jp
AIST Today Vol. 4, No.4 (2004) 16

Energy Electronics Institute (EEI) of National Institute of Advanced Industrial Science and Technology (AIST), succeeded first in the world to synthesize crystalline metal oxide (MO) composite porous materials, that is, composite self-ordered nanoporous materials with a framework of crystalline MO with tailored 3-dimensional structures having regularly arranged nanopores and forming a porous framework. The newly developed material is expected to be applicable to catalyst carrier, adsorbent, photocatalyst, dye-sensitized solar cell, sensor, energy storage device, and so on through the utilization of its electronic and chemical properties as well as molecular sieve features of nanopores.

NB: The result of this study was published in a British science journal, *Nature Materials*, January 2004.



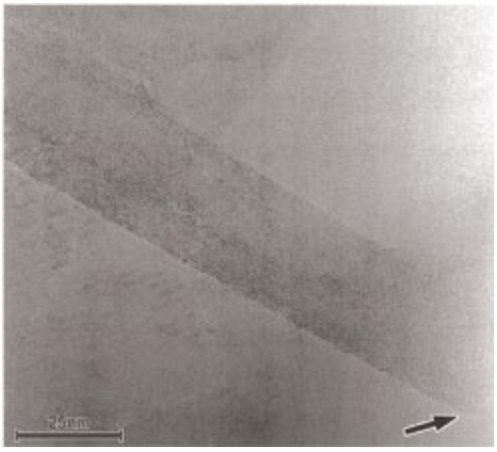
The TEM images of Self-ordered Nanoporous Crystalline Metal Oxide Materials, (a), (b) and (c) for TiO_2-P_2O_5; (d) and (e) for TiO_2-P_2O_5-MnO_2

A New Route to Carbon Nanotubes

- Via the scrolling process of graphene sheets -

Hiroshi SHIOYAMA
Reserch Institute for Ubiquitous Energy Devices
e-mail: shioyama.h@aist.go.jp
AIST Today Vol. 4, No.4 (2004) 18

Potassium-graphite intercalation compound (K-GIC), a kind of donor-acceptor complex of host graphite with potassium was allowed to react with unsaturated hydrocarbons such as stylene. Several tens of minutes after contact with the vapour of monomer, K-GIC was found to have expanded along the c-axis direction. Molecules of unsaturated hydrocarbons are considered to be introduced into the interlayer of K-GIC and polymerized progressively. This suggests that the stacked graphene layers are drawn apart. When polymer was dissolved with an appropriate solvent, a graphene sheet would be isolated. In such a case, graphene sheet will be rolled up to decrease the surface energy. In the scroll between the faced sides of the graphene sheet, van der Waals interaction is expected. The structure is quite different from that of carbon nanotubes prepared by the conventional arc-discharge or laser vaporization method.



High-resolution TEM micrograph of the scrolled-type carbon nanotube