Cluster Control Engineering Group

Professor ● **Motoaki ADACHI**
Associate Professor ● **Shigeki TSUKUI**
Assistant Professor ● **Takuya KINOSHITA**

Research Contents

For the syntheses of thin film and nanostructure, the control of clusters has become an important task. A cluster is an aggregate of a countable number of atoms and molecules. The phenomenon whereby molecules and atoms repeatedly collide with each other in the gas phase and liquid phase, and where the cluster grows into nanometer and submicron particles is called nucleation. It becomes possible to synthesize nanoparticles, functional particles and films by the control of the nucleation.

Gas-phase Synthesis of Nanoparticles

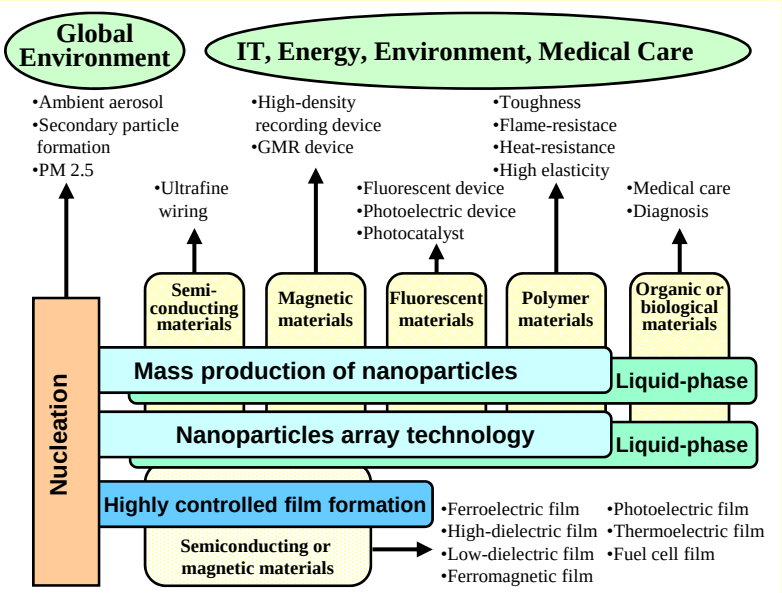
In nanotechnology, it is required that non-agglomerated-nanoparticles of less than 10 nm are synthesized in large quantity and they are aligned. We are attempting to settle this task by giving an electric charge on the particles. The SEM photographs on the right show magnetic nanoparticles synthesized and aligned by the ionization CVD method. Furthermore, we are also attempting to synthesize fluorescent semiconductors nanoparticles, fuel cell materials and catalyst nanoparticles.

Liquid-phase Synthesis of Nanoparticles

We are developing functional nanoparticles with controlled size and structure, which is an advantage characteristic of liquid-phase synthesis, and composite nanoparticles with multiple material phases in one particle. The figure on the right shows composite nanoparticles consisting of gold and magnetic iron oxide, which is intended for applications in medical care and diagnosis.

Multi-Phase Synthesis of Functional Thin Films and Particles

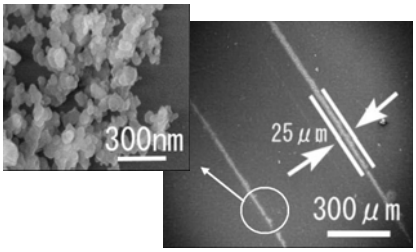
For use in hydrogen based society, functional thin films and particles have been developing by physical or chemical reactions. These targets are follows; (1) Hydrogen generation; electrolysis of water by hollow photocatalysts using visible light or by renewable energy sources as solar cell and thermoelectric devices, which are fabricated by gas-phase or sol-gel methods, (2) Hydrogen use; compact, low temperature and high-efficiency solid oxide fuel cells (see right figure), (3) Hydrogen storage; light and compact hydrogen absorbing alloy.



Research Outline

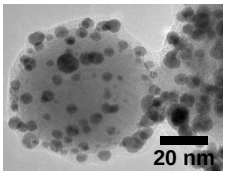
Nanoparticles Array

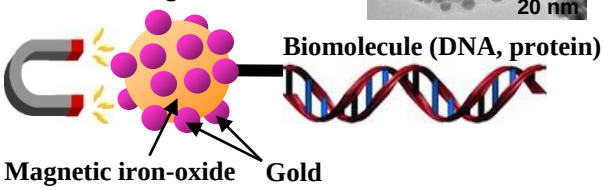
Application in high-density recording media



Nanobio Particle

Application in medical care and diagnosis





Fuel Cell Thin Films

Application to compact, lightweight and high-efficiency fuel cells