Liquid-Crystalline Organic-Inorganic Hybrid Dendron-Modified Fe_3O_4 Nanoparticles: Characterization of the Self-organized Structure

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Magnetic nanoparticles (NPs) exhibit the interparticle-dependent magnetic properties because of strong magnetic interactions from adjacent particles. Therefore, a dynamic control of the magnetic nanoparticles-based array structure is one of the promising techniques that allows us to control the magnetic properties. However, it is still a challenging problem due to strong magnetic interaction between particles. In our previous studies, we have demonstrated that surface modification with liquid-crystalline dendron molecule is a powerful tool to control NP-based structure, since it allows us to introduce the dynamic property of dendrons to inorganic NPs.[1,2)]

In the present study, the dendron-modified Fe_3O_4 NPs have been developed to control the array structure based on magnetic NPs. A typical synthetic procedure is as follows: Firstly, COOH-modified Fe_3O_4 NPs were prepared by a ligand exchange reaction with a terminal COOH-substituted phosphonic acid.[3)] Then, dendron modification was carried out by an amidation reaction between the COOH group on the particle surface and an amino-substituted dendron molecule. The structural analysis was performed by grazing-incidence small angle X-ray scattering (SAXS) for resulting particles. The temperature-dependent SAXS profiles of the dendron-modified Fe_3O_4 NPs in **Figure 1** revealed that array structure was changed dynamically due to thermal phase transition and the structure formed at 170 °C could be assigned as BCC structure. The result indicated that dendron modification enables us to control the array structure based on magnetic NPs.

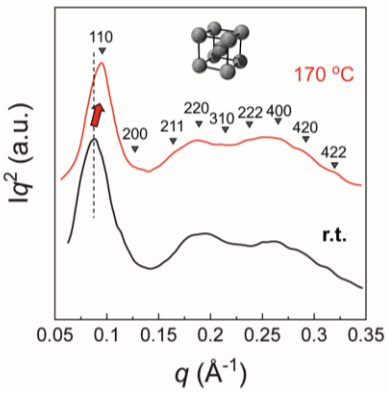

Figure 1. SAXS profiles of dendron-modified Fe_3O_4 NPs at different temperatures.

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