

Production of Co nanocrystals from a C-Co mixture amorphous film by heating experiment in TEM

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Gas evaporation method is one of the simplest production methods of nanoparticles. Growth condition can be controlled by evaporation condition and various compositions of compound nanoparticles can be produced easily by the method. However, ferromagnetic particles produced by the method connect each other like a long chain. In order to produce an isolated ferromagnetic nanocrystal, we tried to produce the isolated ferromagnetic nanoparticles by crystallization from a mixture amorphous film. As a model experiment, Co nanocrystals were produced from a mixture amorphous film of a carbon and Co. The C-Co mixture amorphous film was produced by co-evaporation of carbon and Co in vacuum. The film was heated in TEM from RT to 800°C by in-situ observation. TEM images and ED patterns of the film was taken every 200°C steps.

The co-evaporation film had uniform contrast and amorphous structure. On heating 400°C, black dots were deposited on the film and grew on rising their temperature. On heating 600°C, fcc-Co nanocrystals grew on the film like the black dots and diamond microcrystallites grew in the film. Above 600°C, the black dots began moving on the film and some contrasts like a wheel truck appeared on the film after the black dots moving. The truck contrasts may produce by absorption of carbon atoms into the fcc-Co nanocrystal and diffused onto the surface again. When the absorbed carbon atoms diffused onto the surface, fcc-Co nanocrystals moved and microcrystallites of carbon with the truck like contrasts deposited on the film. The diamond microcrystallites may produced by an influence on the fcc-Co structure as a substrate.