Growth of Gold Nanoparticles in Scanning Electron Microscope

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In-situ liquid phase electron microscopy (LP-EM) allows direct observations of dynamic processes of specimens immersed in liquid.[1] Among various researches, studies of nanoparticle (NP) synthesis using LP-EM are able to provide important insights into the underlying mechanisms in nucleation and growth, which enables design and preparation of functional NPs with unique properties by precisely controlling their size, shape, crystallinity, and composition.[2] In-situ liquid experiments have been mainly carrying out in transmission electron microscope (TEM) instruments because it is possible to achieve an excellent spatial resolution. The use of the STEM detectors in scanning electron microscope (SEM) can make a chance to understand the physical and chemical phenomena related to the interaction between liquid and electron and to monitor the formation of some materials by the incident electrons. In addition, the application area of LP-EM must be expanded by using the large chamber in SEM.

In our study, the growth of gold nanoparticles was monitored by using bright-field and dark-field STEM detector attached in SEM; an electron beam was irradiated to reduce the gold atoms in chloroauric acid aqueous solution. All experiments were carried out by using home-made liquid cell holders. Different crystal growth routes depending on the initial shapes of nanoparticles were observed during the in-situ experiments. The dependence on the current density and the electron energy of the crystal growth was also studied in our experiments. The phenomena appeared in our experiments were interpreted by considering the radiolysis of the chemicals in the liquid by the incident electrons.

Reference

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