

Al-SiO系彗星状粒子成長に関する研究 Comet-like particle growth in Al-SiO

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When a metal was evaporated in an inert gas atmosphere, a vapor of the metal cooled and formed nanoparticles by collision with the inert gas molecules. The nanoparticles grow by coalescence growth and rise on a convection flow of the gas like a smoke. The nanoparticle production method is called a gas evaporation method.

SiO consists of Si and SiO₂. Metal nanoparticles covered with an amorphous SiO layer can be produced by evaporating a mixture powder of the SiO and a metal. However, comet-like particles were grown in the rising smoke using a few kinds of metals¹⁾. In the case of Cr-SiO particle produced by the gas evaporation method, Si was dissolved in a Cr drop at a high temperature region in a smoke. The Si dissolved in the Cr drop was crystallized by supersaturation on cooling process. The Si crystal grew like a tail and the Cr drop became CrSi₂ crystal like a core of comet-like particle. The comet-like particle grew around the eutectic point between Si and CrSi₂. Thus, the comet-like particle grew like a VLS mechanism.

Since Al has a eutectic point with Si, the comet-like particle growth was expected using a mixture powder of Al and SiO. Production of the comet-like particles was tried by the gas evaporation method.

Comet like-particles were produced by evaporation of Al and SiO mixture powder in Ar gas 1.0×10⁴ Pa. The particles were observed by TEM, and analyzed by EDS. It was found that a core part of the comet-like particle consisted of Al or Al and Si, a tail part consisted of Al and O by EDS analysis. ED patterns of the particles indicated that structure of the core part was Si and Al crystals, and the tail part was Al₂O₃ single crystal. Composition of Al and Si in the core part depended on the ratio of Al and Si in the mixture powder. The tail part structure was always Al₂O₃ in every composition. The comet-like particles were grown like a VLS mechanism with SiO₂ reduction and Al oxidation.

1) C. Kaito et.al, J. Crystal Growth **200** (1999) 271.

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