Characteristic Grain Formation in Hydrogen Gas Atmosphere

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Chemical reactions occurring on the surfaces of interstellar grains are of fundamental importance because they allow the formation of certain chemical species at the necessary rates. Most important molecule in space is the H_2 gas because it is by orders of magnitude the most abundant and hence the most frequent collisional partner of other species. The structure of the grain may become the important parameter in gas-phase reaction. In laboratory, the grain formation from the gas phase has attempted as smoke experiments extensively. Metallic and compound grains less than 100 nm in size can be produced by the evaporation of metal in inert gas [1] or mixture gas with O_2 [2]. We recently have succeeded in producing Pt black by use of CO_2 gas replacing the inert gas [3].

Typical metallic grains of Fe, Ni, Co and Si and some silicate compounds have been produced in H_2 gas atmosphere. The characteristic difference on the grain formation in inert gas will be elucidated. Figure 1 shows the transmission electron microscopic (TEM) image of Fe grains produced in various conditions. All these were the bcc structure (a_0 = 0.287 nm). In Ar gas at 10 kPa, the nearly spherical particles were connected the zigzag chain due to the ferromagnetic substance. In H_2 gas atmosphere, the degree of truncation on the {100} Fe surfaces became higher on gas pressure increase. This effect could be only observed in H_2 gas. Hydrogen incorporated into the metal may be influenced the growth form.

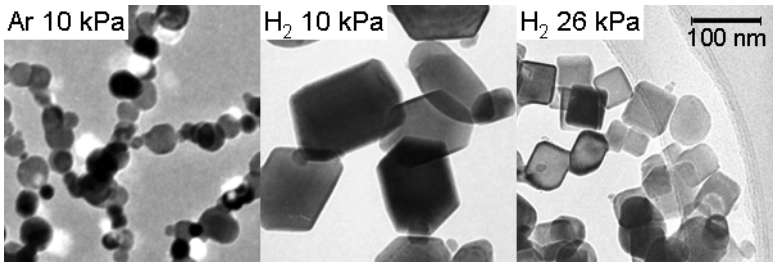

Figure 1. TEM image of iron grains. Scale bar is corresponding to whole micrographs.

References

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