

Selected Abstracts from *Yogyo-Kyokai-Shi*

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The page numbers of the papers appear at the end of the abstract.

The Synthesis of Ultrafine Si_3N_4 in a Hybrid Plasma

Toshihiko TANI*, Toyonobu YOSHIDA and Kazuo AKASHI

Department of Metallurgy and Materials Science,
Faculty of Engineering, The University of Tokyo
7-3-1, Bunkyo-ku 113

* Present address : Toyota Research and Development
Laboratories, Inc.

Ultrafine silicon nitride powders were prepared in a hybrid plasma, which is characterized by the superposition of a radio-frequency plasma and an arc jet. The reactants of SiCl_4 and NH_3 were injected into an arc jet and a tail flame of the hybrid plasma, respectively. The purity of the prepared powder largely depended upon the flow rate of NH_3 . Especially, the nitrogen content in the products increased drastically when the flow rate of NH_3 exceeded about 10 l/min, and reached the value of about 37 wt% at the flow rate of 20 l/min. The prepared powder was soft, fluffy, pure white, and completely amorphous. Moreover, the particle size was from 10 to 30 nm. For a better understanding of the process, thermodynamic equilibrium compositions for the $\text{Ar-H}_2\text{-NH}_3\text{-SiCl}_4$ system were calculated up to 3500 K. Under the assumed conditions, condensed phase of Si is present at the temperature higher than the condensation temperature of Si_3N_4 . A lower flow rate of NH_3 widens the temperature range of the Si existence and promotes the formation of SiCl_4 by recombination processes. These results suggested that the effective "Reactive Quenching" is the key to success for the synthesis of ideal ultrafine Si_3N_4 powder in this process.

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