〈技術資料〉

有機化合物を用いた工業的製法による炭化ホウ素粉末および繊維状炭化ホウ素の作製

Preparation of Boron Carbide Powder and Fibrous Boron Carbide by Industrial Manufacturing Method Using Organic Compound

撹上　将規

Abstract

Boron carbide (B_4C) is an important nonoxide ceramic with attractive properties (low density, high melting point, and excellent hardness) and superior functions (high neutron-absorbing capacity) and is used as an abrasive, wear-resistant component, antioxidant, surface-hardening treatment agent, and reactor materials. The machining of B_4C is extremely difficult owing to its high hardness, thus, a direct synthesis route of fine B_4C powder and fibrous B_4C is required. The carbothermal reduction of boron oxide (B_2O_3) is the general industrial manufacturing method for B_4C powder. We focused on an approach using an organic compound with a number of hydroxyl groups (a polyol) such as glycerin, mannitol, or poly (vinyl alcohol) (PVA) as a carbon source for the carbothermal reduction. A B_4C precursor consisting of B_2O_3 and carbon components arranged on the nanometer scale was prepared by the thermal decomposition of a condensed boric acid (H_3BO_3)-polyol product in air, resulting in the low-temperature synthesis of fine crystalline B_4C powder with little free carbon. Furthermore, condensed H_3BO_3-PVA product fibers could be prepared owing to superior spinnability of a polymer. We successfully fabricated fibrous crystalline B_4C from the fibrous B_4C precursor prepared by the thermal decomposition of electrospun condensed H_3BO_3-PVA product fibers in air.

キーワード：炭化ホウ素、粉末、繊維状構造、熱炭素還元法、ポリオール
Keywords: Boron carbide (B_4C), powder, fibrous structure, carbothermal reduction, polyol

1.　はじめに

ホウ素の炭化物である炭化ホウ素（B_4C）は黒色を呈する半導性の物質であり、優れた物性（低密度、高融点、高硬度）および機能性（中性子吸収能）を兼ね備えた非酸化物セラミックスである。B_4C は高硬度と低比重を兼ね備えていることから、主に研磨材や構造材料などに用いられている。また、高温条件下においても高い耐摩耗性を示すため、耐摩耗材料や切削工具などに利用されている。

本稿では、我々が取り組んでいる有機化合物（ポリオール）を用いた工業的製法（熱炭素還元法）による B_4C 粉末および繊維状 B_4C の作

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KAKIAGE Masaki
群馬大学　大学院理工学府　分子科学部門