MICROWAVE SINTERING OF HIGH THERMAL CONDUCTIVITY ALN

Cheng-Yu Hsieh, Chun-Nan Lin and Shyan-Lung Chung*
Department of Chemical Engineering, National Cheng Kung University
Tainan, Taiwan 701, R. O. C.

ABSTRACT

In this study, a combustion synthesized AlN powder was sintered using microwave as heating source. The microwave was 2.45 GHz and the sintering process was carried out in a single-mode cavity. The sintering temperature was between 1800℃ and 2000℃ with a power ranging from 400 to 700W. The as-synthesized AlN was ground to under 2μm and yttria was used as sintering aid. The effects of the amount of sintering aid, sintering temperature and soaking time on the microstructure and thermal conductivity of the sintered specimens were investigated. The microstructure was characterized by XRD and SEM and the thermal conductivity was measured by a laser flash method. Specimens of high densification (>99.5 % of theoretical density) and high thermal conductivity (～186 W/mK) were obtained with a sintering temperature of 2000℃, a soaking time of 30 minutes and an addition of 3 wt% yttria. Although the microwave effect on sintering is still a topic of discussion, the results show that the microwave is an effective and competitive method for sintering AlN, especially the higher heating rate and shorter soaking time as compared to the conventional sintering. The results also show that the combustion synthesized AlN can be sintered to possess a high thermal conductivity comparable to that of the commercially available AlN powder which is mostly synthesized by carbon thermal reduction method. The present combustion-synthesized AlN powder is characterized to contain high percentages of metal impurities (zirconium and iron). However, these metal impurities do not seem to affect the thermal conductivity as suggested by some studies in the literature. The results show that the primary factor that affects the thermal conductivity is the oxygen contained in the lattice, and this will be discussed.