Thermal Diffusivity/Conductivity of MgAlON-BN Composites

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The thermal diffusivity and heat capacity of MgAlON and MgAlON-BN composites were investigated in the temperature range of 298 to 1300 K using a laser flash technique and a differential scanning calorimeter (DSC) technique respectively. Based on these measurements, the thermal conductivity of the composites was calculated, using knowledge of the densities of the samples. The experimental thermal conductivity results of the composites containing different BN content were found to show a similar trend, which decreased rapidly with increasing temperature at low temperature, followed by a slow decrease with further increasing temperature. This can be explained by the fact that thermal conduction in both components, MgAlON and BN, was dominated by phonons. The phonon mean free path decreased with increasing temperature, but it cannot be shorter than a characteristic length between two neighboring atoms. The BN addition has significant influence on the thermal conductivity. The thermal conductivity of the composites containing BN exhibited a small degree of anisotropy with respect to the preferred orientation of the BN phase. The degree of anisotropy of the composites increased with increasing BN content, which is particularly pronounced with higher BN additions. An equation suitable for present composites was derived based on the Luo model. The predicted lines calculated by the equation had good agreement with experimental results.