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Effect of Mechanical Activation on the Densification Behavior of $MgAl_2O_4$ Spinel

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Magnesium aluminate and other alumina-based spinels attract attention due to their high hardness, high mechanical strength, and low dielectric constant. $MgAl_2O_4$ was produced by solid-state reaction between MgO and α-Al_2O_3 powders. Mechanical activation was used to increase the reactivity of powders and decrease the sintering temperatures. Mechanical activation of mixed powders was performed in a high-energy planetary ball mill in air for 30, 60, 90, and 120 minutes. The resulting powders were characterized to determine the effect of activation on surface area, particle size, and crystallinity. Mechanical activation decreased particle size, increased surface area, and increased the width of peaks in x-ray diffraction. Dilatometry was used to monitor densification behavior up to 1500 ^{o}C. For non-activated powders, sintering started at approximately 1400 ^{o}C, while for activated powders, the onset temperature decreased to about 1340 ^{o}C. Mechanical activation is an efficient method to improve the densification behaviour of $MgAl_2O_4$ produced from mixed oxide powders.