INFLUENCE OF FIELDS ON GRAIN BOUNDARY MOBILITY IN ALUMINA

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While it has been experimentally shown that field assisted sintering results in dense materials in extremely short sintering times (and sometimes and significantly lower sintering temperatures), there is some dispute in the literature regarding how fields affect the grain size. While some reports note a decrease in grain size or no significant change in grain size due to the applied fields, other experiments reported in the literature show an enhanced grain boundary mobility for field assisted sintering. It may be that the lack of quantitative measurements of grain mobility (velocity normalized by the driving force) and/or combined sintering/grain growth experiments have led to this discrepancy in the literature.

In this research systematic annealing experiments on *fully dense* undoped alumina samples were performed in a SPS furnace at 1600°C, without pressure and where heating was either by a current through the graphite die (conventional SPS) or via external heating elements. A significant increase in average grain size as a function of time was observed for the samples annealed in SPS with an electric field. SPS with an applied electric field seems to promote grain growth in alumina, although alumina is a non-conductive ceramic (electronic or ionic). Additionally, the role of carbon on the grain boundary mobility of alumina will be discussed, as carbon is a main impurity when using graphitic tools, such as generally in the SPS systems. Carbon from the furnace environment can go into solution in alumina, and alone and/or combined with external fields, significantly change the sintering and grain growth rate.