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Liquid Phase Sintering: Grain-Growth Induced Densification

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Two theories have so far been developed for explaining densification during liquid-phase sintering. One is the contact flattening theory and the other the pore filling theory. A number of experimental investigations and theoretical evaluations made in the 1980's and 1990's suggest that pore filling is the major densification mechanism. The pore filling theory predicts that densification is governed by grain growth. This prediction should be applicable also to systems with faceted grains in a liquid matrix, for example liquid-phase-sintered Si-based ceramicsand liquid phase-sintered carbides. This prediction has been tested in the WC-Co system. As the initial size of the WC powder increased, densification was enhanced, in agreement with the pore filling theory prediction. The calculated densification kinetics based on pore filling also fitted well with the measured data. The observed densification behavior of WC-Co alloys supports pore filling as being the major densification mechanism in liquid-phase sintering. The densification during liquid-phase sintering is therefore induced by grain growth, unlike in solid-state sintering.