

Impact of Iron Doping on Induction Heating during Spark Plasma Sintering

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Abstract : In this study, γ -Al₂O₃ powders doped with various amounts of iron were sintered via SPS process. Two heating modes - auto and manual mode were applied to observe the role of electrical induction on heating. Temperature, electric current, and pulse pattern were experimented with grade iron γ -Al₂O₃ powders. Phase transformation of γ to α -Al₂O₃ serves as a direct indicator of internal temperature, independently on measured outside temperature. That pulsing in SPS is also able to induce internal heating due to its strong electromagnetic field when dopants are conductive metals (e.g., iron) is proofed during SPS. Density and microstructure were investigated to explain the mechanism of induction heating. In addition, the role of electric pulsing and strong electromagnetic field on internal heating (induction heating) were compared and discussed. Internal heating by iron doping within electrically nonconductive samples is able to decrease sintering temperature and save energy, furthermore it is one explanation for unique features of this material fabrication technology.

Keywords : spark plasma sintering, induction heating, alumina, microstructure

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