

Accelerated cationic diffusion in oxide ceramics under AC-flash event

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Flash sintering, in which densification occurs almost instantaneously above a threshold electric field strength and furnace temperature, has been widely demonstrated in various oxide ceramics. In addition, bulk ceramics show superplastic flow, accelerated sinter forging, good joining performance and crack healing under flash events, suggesting that flash events significantly promote diffusion of constitutive ions. It has been widely accepted that the onset of a flash event is triggered by thermal runaway through Joule heating and increased electrical conductivity. However, several studies suggested that the effect of flash events may involve athermal processes to accelerate diffusional mass transport.

In the present study, the diffusivity of Er^{3+} cations in Y_2O_3 was determined by interdiffusion experiments using $\text{Er}_2\text{O}_3/\text{Y}_2\text{O}_3$ diffusion couples under alternating current (AC) flash events. In the diffusion couple, Er^{3+} cations act as tracers of Y^{3+} in Y_2O_3 , and vice versa. The increase in specimen temperature via Joule heating, which represents the important aspect of flash events, were carefully evaluated by coupling the experimental and numerical approaches. The interdiffusion experiments eventually revealed the athermal acceleration of both lattice and grain boundary diffusion coefficients under AC electric fields.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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