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PROCEEDINGS

The Effect of Heating Rate on Sintering Mechanism of Alumina Nanoparticles

Dangqiang Wang[1] and Hai Mei[1,*]

[1] Hubei Key Laboratory of Theory and Application of Advanced Materials Mechanics, Wuhan University of Technology, Wuhan, 430030, China

[*] Corresponding Author: Hai Mei. Email: meihai3166@whut.edu.cn; liulish@whut.edu.cn

ABSTRACT

The densification process of sintered alumina is mainly controlled by surface, lattice, and interface diffusion, and many experimental researches show that heating rate can affect the transfer of matter. Thus, to further reveal the effect of heating rate on sintering mechanism of alumina nanoparticle, molecular dynamic simulations were performed at five different heating rates to examine the migration of atoms and evolution of microstructure in heating stage. Results show that the sintering process of heating is a typical thermal activation process. High displacement response temperature is caused by high heating rate, which results in the mechanism of atomic migration quickly changing from surface diffusion to overlapping of surface, interface, and lattice diffusion. Nonuniform microstructure and asymmetrical sintered neck forms due to unstable and nonuniform mass transfer. Sintered neck with small radius of curvature leads to high shrinkage rate and large driving force. The sintering mechanism is expected to be helpful for understanding or developing new fast sintering methods for ceramics.

KEYWORDS

Alumina; atomistic simulation; diffusion/diffusivity; heating rate; sinter/sintering

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