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Abstract: Microporous corundum was fabricated by adding nano-sized alumina sol to α-Al_2O_3 micropowder. The nano–micro double-scale effect on the sintering properties and microstructure of microporous corundum was investigated. Results showed that the nano–micro double-scale effect created partial regions in which the alumina sol collected, which showed a larger surface stress than other regions. In the initial stage of sintering, the superplasticity of the alumina sol had a greater influence than its surface effects on the sintering behavior of materials. Plastic deformation occurred among particles as a result of the surface stress, because of the superplasticity of alumina sol. This stress increased the boundary migration velocities and closed the pores prior to their elimination. In the final stage of sintering, the surface effect of alumina sol became dominant over that of its superplasticity. Shrinkage occurred in the partial region simultaneously with grain growth, which led to the formation of intracrystalline pores. Thus, the introduction of alumina sol increased the closed porosity and decreased the bulk density of materials. Despite the slight increase in pore size, the quantity of intracrystalline pores significantly increased. However, excessive shrinkage occurred in the samples with excessive alumina sol; in these samples, the closed porosity was reduced.

Keywords: Sintering, microstructure, microporous corundum, nano-sized alumina sol, closed pores,