Grain Growth Control of $BaTiO_3$ Ceramics with CuO/BaO=2.5 Mixture Addition

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Grain growth of $BaTi_{1.005}O_{3.01}$ during liquid-phase sintering of $BaTiO_3$ ceramics was investigated for CuO-BaO (molar ratio, CuO/BaO=2.5) mixture additions from 0.5wt% to 2wt%. Sintering in air for 2h at 1050°C to 1250°C was investigated to study the densification process, while sintering in air for 1 to 16h at 1150°C to 1250°C was investigated to study the grain growth. The sintered grain morphologies (no grain growth, abnormal grain growth, and normal grain growth) of $BaTi_{1.005}O_{3.01}$ ceramics depend on the amount of CuO-BaO mixture, the sintering temperature, and sintering time. The results were discussed in terms of the phenomenological kinetic grain growth expression: $G^n - G_o^n = K_o\, t \exp(-Q/RT)$. The average grain growth exponents of $BaTiO_3$ with 0.5wt%, 1wt%, 1.5wt%, and 2wt% CuO-BaO mixture addition were 5.193, 4.307, 5.773, and 9.182, respectively. The activation energy for grain growth of $BaTiO_3$ with 0.5wt%, 1wt%, 1.5wt%, and 2wt% CuO-BaO mixture addition were 502±25 kJ/mol, 314±40 kJ/mol, 448±53 kJ/mol, and 392±48 kJ/mol.

Keywords: grain growth, liquid phase sintering, phenomenological kinetic