Synthesis of Low-Density Porous Ceramics by Spark Plasma Sintering of Cenospheres and Fe2NiO4

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Coal-fired power plants still emit large amounts of CO2 and ash annually. To utilize this ash waste, studying applications of cenospheres found in fly ash is necessary. However, there are few studies on spark plasma sintering of porous ceramics from these unique microspheres. Throughout this research project, porous ceramic materials were fabricated by spark plasma sintering (SPS) of cenospheres at various temperatures and with different weight fractions of Fe2NiO4. The effects of sintering temperature and additive concentration on the structural and mechanical properties of the resulting materials were systematically investigated. Experimental results showed that both parameters significantly influenced densification and strength. The highest mechanical strength was achieved for samples sintered at 1250 degrees C with 5 wt% Fe2NiO4. These findings demonstrate that controlled SPS processing enables optimization of cenosphere-based porous ceramics for enhanced mechanical performance and lightweight structural applications.

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