Ni-NiO-Al_2O_3 porous preforms

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ABSTRACT

The performance of attractive Ni-based composites can be affected by changing their microstructures, e.g., introducing pores. Here, we report a novel, relatively low-cost process to fabricate Ni/Al_2O_3 composites with open porosity modified by the size of Al_2O_3 particles. The mixture of powders was subjected to thermal oxidation twice in air after a maximal temperature of 800 °C was reached in a stepwise manner and maintained for 120 min. The oxidation kinetics were determined thermogravimetrically. The open porosity was evaluated by an Archimedes' principle based method. Localization and quantification of NiO, newly formed on the Ni particle surface and acting as a mechanical bonding agent, were explored by scanning electron microscopy with energy dispersive X-ray spectroscopy and X-ray diffractometry. Larger ceramic particles prevented merging of NiO layers on adjacent Ni particles more efficiently; therefore, the open porosity increased from 21% to 24.2% when the Al_2O_3 particle diameter was increased from 5–20 μm to 32–45 μm. Because both Ni/Al_2O_3 composites exhibited similar flexural strength, the composite with larger Al_2O_3 particles and the higher open porosity could be a better candidate for infiltration by molten metal, or it can be directly used in a variety of filtration applications. the composite with larger Al_2O_3 particles could be an excellent candidate for infiltration by molten metal or it can be directly used in filtration applications requiring a good penetrating porosity, substantial corrosion resistance, and suitable mechanical strength.

BIOGRAPHY

Dr. Andrej Opalek has her expertise in powder metallurgy and thermal analysis.

- Research Interest: porous preforms