Thermoelectric properties of ZnO-based ceramics prepared by spark plasma sintering technique

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The scarcity and toxicity of high performance thermoelectric materials (such as Bi, Pb, Sb, Te etc.) has shifted research to focus on metal oxides and organic materials. Recently, inorganic–organic hybrids are of interest due to minimized thermal conductivity and selective scattering of charge carriers that leads to high sea beck coefficient. In this work, Zn$_{0.96}$Al$_{0.04}$O prepared through co-precipitation route was sintered using spark plasma sintering. Polyaniline (PANI) concentrations of 5wt% and 9wt% were compared. High dense ceramic of 98.5±0.03% was obtained at a low sintering temperature of 250°C using Zn$_{0.96}$Al$_{0.04}$O/5wt% PANI. Increasing PANI concentration decreased the relative density. Incorporation of PANI into the inorganic material reduced the thermal conductivity from 27 W/mK (0 wt% PANI) to 5.2 W/mK (5 wt% PANI) and 3.2 W/mK (9 wt% PANI) at 40°C. Maximum ZT of 2.2x10$^{-6}$ is obtained at 200°C with PANI concentration of 9 wt%. These findings are an opening for low temperature applications of ZnO-based ceramics.

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Biography

P M Radingoana is a PhD student at Université Paul Sabatier-CIRIMAT. She is currently working on “Spark plasma sintering of ZnO/polymer composites for thermoelectric application”. Her research interests include Renewable Energies and Sustainable Development.

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