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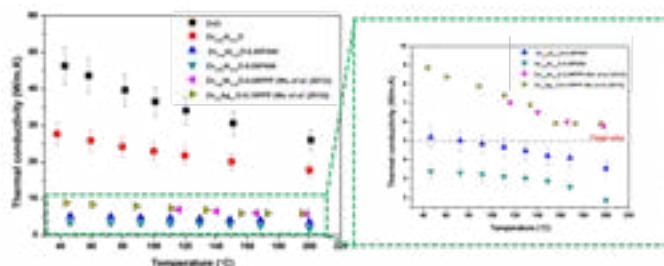
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Thermoelectric properties of ZnO-based ceramics prepared by spark plasma sintering technique

P M Radingoana¹, S Guillemet-Fritsch¹, P A Olubambi², C Estournès¹ and J G Noudem³¹Université de Toulouse, CIRIMAT, CNRS INPT UPS, Université Paul-Sabatier, Toulouse, France²University of Johannesburg, South Africa³Crismat-Ensicaen, France

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 Seebeck 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 $98.5 \pm 0.03\%$ was obtained at a low sintering temperature of $250^\circ C$ 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 $40^\circ C$. Maximum ZT of 2.2×10^{-6} is obtained at $200^\circ C$ with PANI concentration of 9 wt%. These findings are an opening for low temperature applications of ZnO-based ceramics.



Recent Publications

1. Wu Z H, Xie H Q, Wang Y-Y, Xing J J and Ma J H (2015) Nano junctions Contributing to High Performance Thermoelectric ZnO-Based Inorganic-Organic Hybrids. Chinese Physics Letters 32(11):117303.
2. Wu Z H, Xie H Q and Zhai Y B (2013) Enhanced thermoelectric figure of merit in nanostructured ZnO by nano junction effect. Applied Physics Letters 103(24):243901.
3. Li J, Tang X, Li H, Yan Y and Zhang Q (2010) Synthesis and thermoelectric properties of hydrochloric acid-doped polyaniline. Synthetic Metals 18(3):53-55.
4. Mitra M, Kargupta K, Ganguly S, Goswami S and Banerjee D (2017) Facile synthesis and thermoelectric properties of aluminum doped zinc oxide/polyaniline (AZO/PANI) hybrid. Synthetic Metals 228:25-31.
5. Zhang D B, Zhang B P, Shang P P, Gao C and Zhang Y Q (2014) Effect of $ZnAl_2O_4$ phase on thermoelectric properties of Al doped ZnO ceramics fabricated by spark plasma sintering. Materials Research Innovations 18(4):110-115.

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.

radingoana@chimie.ups-tlse.fr