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N M Ferreira et al., J Nucl Ene Sci Power Generat Technol 2018, Volume 7
DOI: 10.4172/2325-9809-C2-011

3rd International Conference on

Power and Energy Engineering

December 03-04, 2018 | Rome, Italy

Laser processing of $CaMnO_3$-based materials for thermoelectric applications

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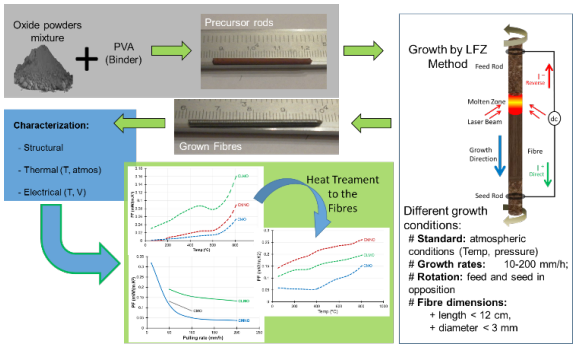
Today, a particular interest is given to the oxide-based thermoelectric materials, due to enhanced thermal and redox stability, attractive properties at high temperature, the absence of toxicity, and natural abundance of the constituent compounds. The objective of this work is to assess the possibilities for processing oxide thermoelectrics through laser floating zone (LFZ) method, including identification of the appropriate treatment conditions and main structural and microstructural factors affecting the thermoelectric performance. Known Nb- and La-substituted calcium manganite-based materials, possessing promising thermoelectric properties, were selected as a model system. Detailed structural (XRD) and microstructural (SEM/EDS) studies were performed for the samples, grown at various pulling rates. The results on electrical conductivity, Seebeck coefficient and thermal conductivity indicate that high thermoelectric performance can be triggered by laser processing. Effects of pulling rate, dopants and thermal treatment to the fibres on these properties are discussed, suggesting that careful optimization of the laser treatment conditions is necessary, when seeking high thermoelectric performance in oxides by LFZ processing.



Recent Publications

1. N M Ferreira, F M Costa, A V Kovalevsky, M A Madre, M A Torres, et al. (2018) New environmentally friendly Ba-Fe-O thermoelectric material by flexible laser floating zone processing. Scripta Materialia 145(2018):54–57.
2. N M Ferreira, S Rasekh, A V Kovalevsky, F M Costa, M A Madre, et al. (2017) Thermoelectric oxides processed by laser floating zone technique. J. Mat Sci. 5(2017):5.
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4. A Sotelo, F M Costa, N M Ferreira, A Kovalevsky, M C Ferro, et al. (2016) Tailoring $Ca_3Co_4O_9$ microstructure and performances using a transient liquid phase sintering additive. J. Eur. Ceram. Soc. 36(2016):1025.
5. M A Madre, F M Costa, N M Ferreira, S I R Costa, Sh Rasekh, et al. (2016) High thermoelectric performance in Bi_2-x$Pb_xBa_2Co_2O_x$ promoted by directional growth and annealing. Journal of the European Ceramic Society 36(2016):67–74.

Biography

N M Ferreira completed his degree in Physics Engineering from the University of Aveiro and completed his PhD in Physics Engineering in 2014. From the year 2015 he is a researcher at I3N - pole UA, was an associate member+ assistant teacher in UA-DF. He has a good knowledge in laser systems, structural characterization techniques, and AC and DC electric measurements homemade systems.

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