Short Communication

Innovative design of bismuth-telluride-based thermoelectric micro-generators with high output power

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ABSTRACT: The ever-increasing number of connected objects requires novel ways to power them and make them fully autonomous. In this context, photovoltaic, piezoelectric or thermoelectric energy-harvesting technologies show great promises as they make possible the conversion of solar radiation, motion or thermal energy into useful electricity for charging micro-batteries for instance. Thermoelectric micro-generators (μ-TEGs) exhibit several key benefits, making them prime candidates for harvesting any temperature difference between their two exchange surfaces. However, their output power critically depends on the design of the μ-TEG, the minimization of the detrimental influence of the contact resistances and on the coupling of the μ-TEG with the heat source and heat sink. Here, we theoretically and experimentally demonstrate how these inherent difficulties can be mitigated using an innovative, smart flexible μ-TEG design based on bismuth telluride thin films. Our experimental findings show that an output power of 5.5 μW per thermocouple can be generated under a temperature difference of only 5 K, in excellent agreement with predictions based on three-dimensional finite element analyses. These remarkable results rank our μ-TEG among the best micro-generators currently available..

Biography

Bertrand Lenoir completed his PhD from Lorraine University (France) and has been teaching Physics and Materials Science at Ecole Nationale Supérieure des Mines de Nancy (France) since 1994. His research, performed at Institut Jean Lamour (France), focuses on experimental studies of thermoelectric properties in a variety of materials. Much of recent efforts have been directed towards the identification and exploration of novel thermoelectric materials and the development of modules for electrical power generation from waste heat. He has published more than 185 publications in international peer-review journals, has supervised Ph.D. thesis of fifteen graduate students and mentored twelve postdoctoral researchers. He is serving as an Editor or Editorial Board Member for Applied Sciences, Energy, Materials and Open Physics. He is also serving on the board of the European Thermoelectric Society (ETS) and is the Director of the French "Groupement d'Intéret Scientifique" (GIS) on Thermoelectric

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