SYNTHESIS OF BISMUTH TELLURIDE NANOWIRES

Stein N.[1], Gravier L.[2-3], Frantz C[1]., Yu H.[2], Granville S.[2] and Ansermet J-Ph.[2]

1- LCSM, Nancy-Université, UPVM, CNRS, 1 Bd. Arago, F-57078 Metz, France
2- Institut de Physique des Nanostructures, Ecole Polytechnique Fédérale de Lausanne
CH-1015 Lausanne-EPFL, Switzerland
3- Montena SA, CH-1753, Matran, Switzerland

It has been shown theoretically that the thermoelectric materials of nanometric dimensions may have Seebeck coefficients greater than their large counterparts. This increase is linked to an improvement in densities of electronic state near the Fermi level and the reduction in the contribution of lattice thermal conductivity. Among the nanostructures, thermoelectric nanowires are studied due to their increased figure of merit.
The objective of this work is to develop synthesis methods, based on the electroplating (ECD) of nanowires in porous polycarbonate membranes. ECD is a low cost method, allowing obtaining nanowires with diameters down to 30nm at room temperature and at ambient pressure. Various compositions of thermoelectric compounds ($Bi_{2+x}Te_{3-x}$, $Bi_{2-x}Te_{3+x}$, $Bi_{1.5}Sb_{0.5}Te_3$ and $Bi_2Te_{2.7}Se_{0.3}$) will be covered. The challenge of this scientific development is to improve the filling rate in the porous template. Thus the experimental parameters of electroposition are developed with the aim to obtain uniform growth rate. This aspect should allow increasing the rate of electrical contacts at the bottom of the wires, which will lead to quantifiable measurements of properties of nanowires and optimal performances of thermoelectric devices.
Their transport properties are investigated as energy conversion efficiency of a large bunch of nanowires, here detailed: thermoelectric power and heat conductivity.

E-mail Contact Author : nicolas.stein@univ-metz.fr