Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Flexible Thermoelectric Fabrics Based on Layered Topological Insulator Bi_2Se_3 Nanoplates/Polyvinylidene Fluoride Composite[1]

CHAOCHAO DUN, COREY HEWITT, HUIHUI HUANG, DAVID CARROLL, Center for Nanotechnology and Molecular Materials, Department of Physics, Wake Forest University, Winston-Salem, NC 27109, U. S — We report a highly-flexible and ultrathin thermoelectric fabrics based on topological insulator (TI) Bi_2Se_3 Nanoplates/PVDF Composite, which show a room temperature Seebeck coefficient, electrical conductivity, and figure of merit ZT -8 μV/K, 5000 S/m, 0.02, respectively. This results demonstrate that Bi_2Se_3 Nanoplates/PVDF composite exhibit favorable thermoelectric characteristics, which opens a new avenue to fabricate highly-flexible and lightweight sustainable energy sources that could be compatible with portable/wearable electronic devices. The low thermal conductivity of the composites ($\sim$ 0.42 W/(mK)) suggests the nonconducting host polymer matrix PVDF serves to bind the conducting topological insulator (TI) Bi_2Se_3 while still maintaining an adequate power factor and figure of merit. The flexible thermoelectric fabrics based on layered topological insulator Bi_2Se_3 Nanoplates/PVDF composite that with comparable thermoelectrical efficiency is only a typical example that showing the promising of the present method for further applications of 2D topological insulator like Bi_2Se_3, Bi_2Te_3 and Sb_2Te_3 At their current performance, if enough thermal energy is available, the composites could be used to provide sufficient thermoelectric power for low powered personal and portable electronics.

[1]This study was conducted under support from the Air Force Office of Scientific Research Grant Number FA 9550-13-1-0085.

Chaochao Dun
Center for Nanotechnology and Molecular Materials,
Department of Physics, Wake Forest University,
Winston-Salem, NC 27109, U. S

Date submitted: 14 Nov 2014 Electronic form version 1.4