Supporting Information

Enhanced Thermoelectric Properties of Flexible Cu₂Se NW/Polyvinylidene Fluoride Composite Films Fabricated via Simple Mechanical Pressing

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1. Experiment details

Copper (II) nitrate trihydrate, 99% from ACROS, Sodium selenite (Na₂SeO₃, 99%) from Alfa Aesar, Ethylene glycol (99.5%) extra pure from SAMCHUN and Potassium hydroxide pellets extra pure from DAEJUNG were used without further purification.

Cu₂Se NW/PVDF composite flexible thin films were prepared by various approaches, such as drop casting (DC), Vacuum Filtration (VF) and Vacuum Filtration Followed by Mechanical Pressing (VFMP)

- 1.1 Drop casting (DC): The as-synthesized Cu₂Se NWs powder (300 mg) and PVDF (150 mg) in a 2:1 ratio were dissolved in 5 mL dimethylformamide solution (DMF) and sonicated for 3 h to produce a uniform mixture. The mixture was drop-cast onto the glass substrate and allowed to bake on a hot plate at 80 °C over night under air.
- **1.2 Vacuum Filtration (VF):** The synthesized Cu₂Se NWs were dispersed in DI water after centrifugation and sonicated for 3 hrs to ensure the formation of a uniform mixture. Cu₂Se NW film was prepared by vacuum filtration using porous mixed cellulose ester (MCE) filter membranes (Pore size of 0.45 μm, Ø 56mm). To insure the fixation of as-deposited NW film

that would not flow during transfer onto a glass substrate, we cut the film to fit the size of the glass. In the present study, the film was cut into a 4×4 cm rectangle shape and then Cu₂Se NW film on a MCE membrane was transferred onto a 4×4 cm glass at 60 °C and 2,000 PSI for 3 hours. Subsequently, the MCE was peeled from the glass leaving the Cu₂Se NW film on the substrate, which was followed by annealed at 100 °C under vacuum for 1 hr. 5 ml PVDF solution (200 mg) was drop-coated onto Cu₂Se NW film and heated at 70 °C for 2 hrs to assure solvent evaporation.

1.3 Vacuum Filtration Followed by Mechanical Pressing (VFMP): After peeling the MCE membrane from the glass substrate in preparation method 2 (vacuum filtration), the Cu₂Se NW film on the glass substrate was subjected to a pressure of 3,000 PSI for 10s. Subsequently annealing was performed at 100 °C under vacuum for 1 hr. Later, 5 ml PVDF solution (200 mg) was drop-coated onto the Cu₂Se NW film, which was then heated at 70 °C for 2 hrs in order to evaporate the solvent.



Fig.S1. Schematic diagram for bending process



Fig. S2 EDS analysis of as synthesized $Cu_{2-x}Se$ NWs, showing Cu/Se ratio of 1.74. The corresponding SEM image was also given.



Fig. S3 Cross-sectional SEM images of the Cu₂Se NW/PVDF composite films fabricated via (a) simple drop casting (DC), (b) vacuum filtration (VF), and (c) vacuum filtration followed by mechanical pressing (VFMP), respectively.