

NASA SBIR/STTR Technologies

Proposal No. **T8.01-9920** – *Ultraefficient Thermoelectric Devices*

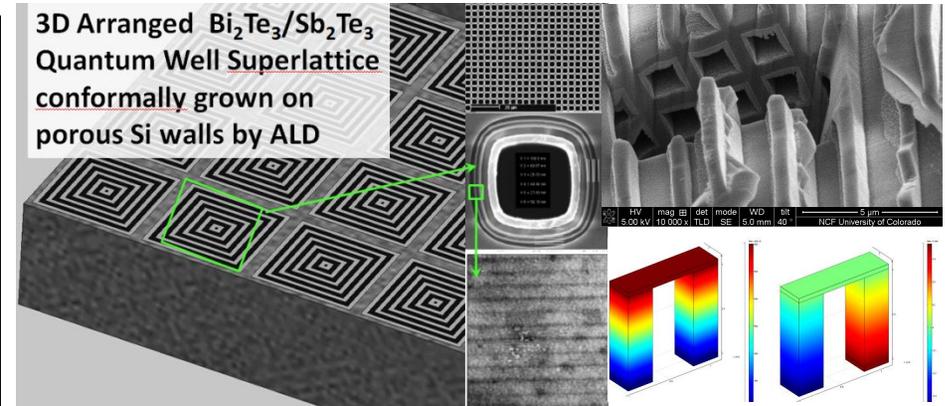


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Identification and Significance of Innovation

New high conversion efficiency TE devices, as well the manufacturing methods need to be developed to meet the growing NASA, DoD and commercial needs in thermoelectric energy. The team of MicroXact Inc., Sundew Technologies Inc. and Virginia Tech is proposing to develop a revolutionary ultrahigh efficiency thermoelectric material fabricated on completely new fabrication principles. The material comprises the three-dimensional $\text{Bi}_2\text{Te}_3/\text{Sb}_2\text{Te}_3$ Quantum Well Superlattices fabricated by a conformal coating of macroporous silicon (MPSi) pore walls. Such a material will provide $ZT > 2$ at macroscopic thicknesses of the material, permitting 15% or more conversion efficiencies

Expected TRL Range at the end of Contract (1-9): 4-5



Technical Objectives and Work Plan

Technical Objectives:

- ÉO1 ó Demonstrate ALD deposition of high-ZT Bi_2Te_3 / Sb_2Te_3 superlattice on porous silicon template.
- ÉO2 ó Develop TE material and demonstrate $ZT > 2$.
- ÉO3 - Develop TE device and demonstrate efficiency $> 15\%$.
- ÉO4 ó Finalize commercialization strategy

Work Plan:

- ÉTask 1 ó Design 2nd generation ultraefficient TE material.
- ÉTask 2 ó Improve MPSi template fabrication.
- ÉTask 3 ó Develop ALD coating processes.
- ÉTask 4 ó Characterize developed materials and devices.
- ÉTask 5 - Develop/ TE generator prototype .
- ÉTask 6 - Finalize commercialization and transition to manufacturing strategy .

NASA and Non-NASA Applications

- ÉPower generation on board of spacecraft (NASA).
- ÉCooling of electronic components (NASA, DoD, commercial).
- ÉWaste heat recovery (NASA, DoD, commercial).
- ÉResidential cooling and refrigeration (commercial).
- ÉIndustrial Waste Heat, Arc Furnaces, Smelting Cells, etc. (commercial)
- ÉPremium Portable Power (DoD, commercial)
- ÉWaste Heat, Geothermal Power Plants (DoE, commercial).

Firm Contacts

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NON-PROPRIETARY DATA