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Student Abstract Example

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Title: *Enhanced Waste Heat - Energy Conversion Through Nanostructured Thermoelectrics*

ABSTRACT:
The problem of waste heat recovery and heat dissipation is of considerable relevance to energy conservation. Two major industries are the primary sources of waste heat: (1) Transportation vehicles with waste heat emitted from the exhausts of cars and trucks. (2) Basic material industries (oil refineries etc.). Additionally, 42% of the solar radiation is in the form of heat and is freely available for use. In this context, thermoelectric materials can be used to convert the waste heat into useful electricity.

While bulk thermoelectric materials were traditionally not considered to have high efficiencies (~ 6%) for waste heat recovery applications, recent advances in nanotechnology together with better materials fabrication tools have brought forth the possibility of artificially fabricated quantum confined structures, such as quantum wells and nanowires, which have been predicted and shown to have orders of magnitude higher electrical conversion efficiency (~ 20%). It has also been conclusively shown that thermoelectric material based devices are particularly advantageous with decreasing size (C. Vining, Al Gore energy solutions Summit, 2008). In our presentation, we will consider and explain the characterization and the incorporation of these nanostructures into macro-scale structures through novel, but well established assembly techniques.

Our research into thermoelectrics is a disruptive technology which is able to drastically reduce our energy dependence on oil without a major change in people's lifestyle. In this context, a simple example on the possible utilization of TE power is illustrative. For a 100 HP car even if 2% of such waste heat is converted to useful electrical power it will amount to 1 kW, or potentially 250 GW for 250 million vehicles. If each vehicle runs 4 hrs a day such thermoelectric energy harvesting technology is able to supply 1 TWhr per day, enough to power 12.5 million households! Consequently, thermoelectric devices could represent a multi-billion dollar industry with enormous market potential.