NANO HIGHLIGHT
NANOFIBER MANUFACTURING FOR ENERGY CONSERVATION

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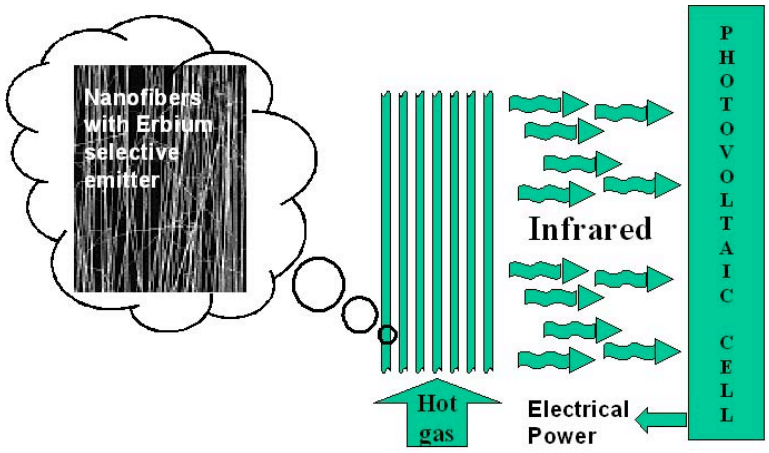
The conversion of waste heat from vehicle engines or industrial processes into useful electric power can be economically valuable if the cost of the conversion device is low, even if maximum efficiency is not achieved, since the thermal energy, which is cost free, would otherwise be uselessly dissipated into the environment. Recovery of 10% of the wasted thermal energy from automobiles amounts to tens of billions of gallons of gasoline per year. This is our over-arching goal. Conversion of waste heat from even lower temperature sources is a secondary goal of this project, since lower temperature sources of waste heat are ubiquitous.

The principle of thermo-photo-voltaic (TPV) devices is illustrated in the diagram. Waste heat, in the form of hot gas, heats a selective emitter, which radiates with greater than black body intensity at particular wavelengths. The emitted radiation in this intense band is converted to electrical energy by an efficient photodiode. Thermo-photo-voltaic devices (TPV) are presently in an emerging state of development. Nanofibers provide routes to better designs and manufacturing methods.

A prototypical selective emitter is a trivalent rare earth ion, such as erbium 3^+ which emits light in the wavelength range from 1 to 1.5 microns. A photovoltaic cell made of InGaAs is the most efficient converter of light to electricity in this wavelength range. This structure has low mass and no moving parts. The device can be designed to fit the exhaust of an automobile engine or to utilize heat from many other gas flow or combustion structures.



Laboratory scale TPV systems based on ceramic nanofibers containing erbium ions were designed, constructed and tested to obtain information needed for optimization and construction of practical systems. Invention disclosures and publications have been made. The interdisciplinary team of investigators associated with the University of Akron includes physicists, chemical, electrical and mechanical engineers, chemists, polymer scientists and mathematicians. Talented high school students, directed by a science teacher supported partly by this project are contributing to the effort.

References

1. For further information about this project, send email to reneker@uakron.edu.