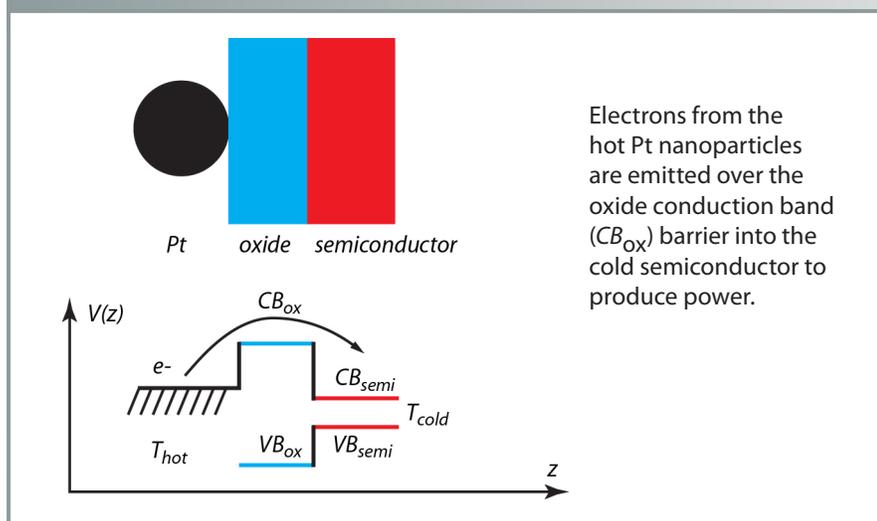


Solid State eBurner for Supplying Power to Laptops, Cellphones

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Electrons from the hot Pt nanoparticles are emitted over the oxide conduction band (CB_{ox}) barrier into the cold semiconductor to produce power.

Technology Summary

Researchers at ORNL invented a device that converts energy from thermoelectric materials to power for cell phones, laptops, and other portable electric devices. This unique means of producing power is more powerful, lighter, and smaller than existing technologies. Because the only byproducts from this invention are carbon dioxide and water vapor, a substantial reduction in environmental impact from conventional battery disposal is possible with wide-spread use of this device.

Thermoelectricity is the conversion from temperature differentials to electricity, or vice versa. The ORNL solid state converter has a thermally insulating separator layer on one side with an electron emitter made of a metal nanocatalytic layer, and on the other side a semiconducting collector layer. The emitter layer and collector layer are coupled to electrically conductive leads that complete an electrical circuit.

The device works by thermionic emission, where the flow of electrons from a metal surface is caused by thermal vibrational energy overcoming the forces that hold electrons to atoms at the surface. The invention includes providing a thermoionic converter, a fuel, and an oxidant to the electron emitter. The fuel and oxidant spontaneously react on the emitter surface of metal nanoparticles, generating heat sufficient to cause thermionic emission of electrons. These penetrate through the separator layer to the collector layer. The emitter and the collector layer are electrically connected to complete a circuit. Outputs from several converters can be coupled to a portable electronic device to supply power.

Advantages

- Environmentally friendly during operation and disposal
- Micro-fabricated structure suitable for mass production and low unit cost
- More powerful, lighter and smaller than other existing technologies
- Complete solid state structure with no moving parts, minimizes maintenance
- Built-in micro-fluidic system for fuel storage, fuel dispensing and system cooling
- Critical parameters can be manipulated using a physics-based, atomic layering approach to device fabrication

Potential Applications

- Portable electronics, including cell phones and laptops

Patent

Zhiyu Hu. *Solid State Transport-Based Thermoelectric Converter*, U.S. Patent US 7,696,668, issued April 13, 2010.

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