**Global Challenges/Chemistry Solutions**

**Our Sustainable Future: Ancient effect harnessed to produce electricity from waste heat**

Combating disease . . .  promoting public health … providing clean water and safe food . . . developing new sources of energy . . . confronting climate change. Hello, from the American Chemical Society — the ACS. Our more than 164,000 members make up the world’s largest scientific society. This is “Global Challenges/Chemistry Solutions: New Solutions 2012.” Global Challenges 2012 updates the ACS’ award-winning podcast series.

Today’s episode describes how a phenomenon first observed by an ancient Greek philosopher 2,300 years ago has become the basis for a new device designed to harvest the enormous amounts of energy wasted as heat each year to produce electricity. The first-of-its-kind “pyroelectric nanogenerator” is the topic of a report in ACS’ journal Nano Letters.

Zhong Lin Wang, Ph.D., who is with Georgia Tech and is the lead author of the paper, notes that more than 50 percent of the energy generated in the U.S. each year goes to waste, much of it as heat released to the environment by everything from computers to cars to long-distance electric transmission lines. Heat can be converted to electricity, using something called the pyroelectric effect, first described by the Greek philosopher Theophrastus in 314 B.C., when he noticed the gemstone tourmaline produced static electricity and attracted bits of straw when heated.

Heating and cooling rearrange the electronic structure of certain materials, including tourmaline, and create an imbalance of electrons that generates an electric current. Wang’s group wanted to apply the ancient principle to make a nanogenerator that could take advantage of heat changes in the modern world, which uses a time-dependent temperature change to generate electricity. He explains:

 *“We made nanowires out of zinc oxide, a compound added to paints, plastics, electronics and even food. Using an array of short lengths of nanowire standing on end, we demonstrated a device that produces electricity when heated or cooled.”*

He suggests that the nanogenerators could even produce power as temperatures fluctuate from day to night.

*“This new type of nanogenerator can be the basis for self-powered nanotechnology that harvests thermal energy from the time-dependent temperature fluctuation in our environment for applications such as wireless sensors, temperature imaging, medical diagnostics and personal microelectronics.”*

**Smart Chemists/Innovative Thinking**

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Today’s podcast was written by Michael Bernstein. I’m Sarah Rouhi at the American Chemical Society in Washington.