The Chinese University of Hong Kong
Faculty of Science / Department of Physics

C N Yang Lecture in Physics

Nanogenerator for Self-powered Systems and Large-scale Blue Energy

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Abstract

Triboelectrification is an effect that is known to each and everyone probably ever since the ancient Greek time. It is usually recognized as a negative effect and is avoided in many technologies. We have recently invented a triboelectric nanogenerator (TENG) that is used to convert mechanical energy into electricity by a conjunction of triboelectrification and electrostatic induction. In this power generator, there are the inner and the outer circuits. A potential is created by the triboelectric effect due to the charge transfer between two thin organic/inorganic films that exhibit opposite tribo-polarity in the inner circuit. In the outer circuit, electrons are driven to flow between the two electrodes attached on the back sides of the films in order to balance the potential.

Ever since the first report of TENG in January 2012, the conversion efficiency of ~50% has been achieved. TENG can be applied to harvest all kinds of mechanical energy that is available but wasted in our daily life, such as human motion, walking, vibration, mechanical triggering, rotating tire, wind, flowing water and more. Alternatively, TENG can also be used as a self-powered sensor for detecting static and dynamic processes arising from mechanical agitation by using the voltage and current output signals of the TENG, respectively. It also has the potential applications in touch pad and smart skin technologies. TENG is possible not only for self-powered portable electronics, it presents a new energy technology with potential of contributing to the global energy in the future.

Biography

Dr. Zhong-Lin (ZL) Wang is the Hightower Chair in Materials Science and Engineering and Regents' Professor at Georgia Tech, and Founding Director and Chief Scientist at the Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences. Dr. Wang has made original and innovative contributions to the synthesis, discovery, characterization and understanding of fundamental physical properties of oxide nanobelts and nanowires, as well as applications of nanowires in energy sciences, electronics, optoelectronics and biological sciences. His recent discovery and breakthrough in developing nanogenerators establish the principle and technological road map for harvesting mechanical energy from environment and biological systems for powering personal electronics. His research on self-powered nanosystems has also inspired the worldwide effort in academia and industry for studying energy for micro-nano-systems.

Dr. Wang was elected as a foreign member of the Chinese Academy of Sciences in 2009, member of European Academy of Sciences in 2002, fellow of American Physical Society in 2005, fellow of AAAS in 2006, fellow of Materials Research Society in 2008, fellow of Microscopy Society of America in 2010, fellow of Royal Society of Chemistry, and fellow of the World Innovation Foundation in 2002. He received the 2016 Distinguished Scientist Award from (US) Southeastern Universities Research Association, the 2015 Thomas Routers Citation Laureate award, the 2014 World Technology Prize in Materials; the 2014 James C. McGroddy Prize for New Materials from America Physical Society, the 2011 MRS Medal from Materials Research Society, the 1999 Burton Medal from Microscopy Society of America. He has authored over 1100 peer reviewed journal articles, including 16 in *Nature* and *Science, and 16 in Nature sister journals*. From SCI data base, his entire publications have been cited for over 100,000 times with an h-index of 155; Google scholar gives a citation of 150,000 with an h-index of 180. http://www.nanoscience.gatech.edu

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