New forms of highly efficient, flexible nanogenerator technology

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[1]

Can a heart implanted micro robot operate permanently? Can cell phones and tiny robots implanted in the heart operate permanently without having their batteries charged?

It might sound like science fiction, but these things seem to be possible in the near future.

The team of Prof. Keon Jae Lee (KAIST, Dept. of Materials Science and Engineering) and Prof. Zhong Lin Wang (Georgia Institute of Technology, Dept. of Materials Science and Engineering) has developed new forms of highly efficient, flexible nanogenerator technology using the freely bendable piezoelectric ceramic thin film nano-materials that can convert tiny movements of the human body (such as heart beats and blood flow) into electrical energy.

The piezoelectric effect refers to voltage generation when pressure or bending strength is applied to piezoelectric materials. The ceramics, containing a perovskite structure, have a high piezoelectric efficiency. Until now, it has been very difficult to use these ceramic materials to fabricate flexible electronic systems due to their brittle property.

The research team, however, has succeeded in developing a bio-eco-friendly ceramic thin film nanogenerator that is freely bendable without breakdown.

Nanogenerator technology, a power generating system without wires or batteries, combines nanotechnology with piezoelectrics that can be used not only in personal mobile electronics but also in bio-implantable sensors or as an energy source for micro robots. Energy sources in nature (wind, vibration, and sound) and biomechanical forces produced by the human body (heart beats, blood flow, and muscle contraction/relaxation) can infinitely produce nonpolluting energy.

Prof. Keon Jae Lee (KAIST) was involved in the first co-invention of "High Performance Flexible Single Crystal Electronics" during his PhD course at the University of Illinois at Urbana-Champaign. This nanogenerator technology, based on the previous invention, utilized the similar protocol of transferring ceramic thin film nano-materials on flexible substrates and produced voltage generation between electrodes.

Prof. Zhong Lin Wang (Georgia Tech, inventor of the nanogenerator) said, "This technology can be used to turn on an LED by slightly modifying circuits and operate

touchable flexible displays. In addition, thin film nano-materials ('barium titanate') of this research have the property of both high efficiency and lead-free bio compatibility, which can be used in future medical applications."

SOURCE [2]

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