SPECIAL ISSUE: Flexible and Stretchable Energy

Preface: innovative flexible energy

Continuous progress in energy science and technology improves the quality of our life. The realization of flexibility and stretchability in electronics is expected to open up the possibility of many new applications. Innovation in energy science and technology as well as the strong consumer market demand for portable, ultrathin/lightweight and flexible devices, such as roll-up displays, touch screens, active radio-frequency identification tags (RFID), smart electronics, wearable sensors and implantable medical devices, are driving the rapid development of flexible electronics.

However, all the targets cannot be realized unless corresponding power sources are developed, and this is the bottleneck. Recently, lithium ion batteries (LIBs), supercapacitors, also known as electrochemical capacitors (ECs), photoelectric conversion devices (or known as solar cells), piezoelectric generators, and mechanically activated chemiluminescence devices have made key breakthroughs in the realization of flexibility and stretchability. Therefore, *SCIENCE CHINA Materials* organizes this hot topic “*Flexible and stretchable energy*” to show the recent development and challenge in these fields.

For flexible LIBs, the power and energy supply as well as cyclic stability will not be compromised under frequent mechanical strains, such as under bending, twisting or other deformation modes for long-term use. Therefore, materials with unique structures and excellent electrochemical performances are highly desirable. Fu *et al.* review 2D materials for flexible energy conversion and LIBs.

A flexible and high-voltage EC with ultrahigh energy density has excellent thermal stability, high ionic conductivity, and the properties of being nonvolatile, nonflammable, and nontoxic. Ma *et al.* give a perspective for flexible solid-supercapacitors with polymer hydrogel materials. Tong and Lu *et al.* provide a topic of carbon materials for stretchable supercapacitors according to recent development of ECs.

Flexible photoelectric conversion device has attracted a great deal of attention because of getting energy from sunlight or indoor light and converting it to electricity. Their lightweight and processability, and the ease of material de-

sign on the molecular level show magic power. Sun *et al.* provide their new molecules as alternative to fullerene for organic photovoltaic devices. Xu and Bo *et al.* give a perspective of ternary blend polymer for high performance solar cells. Guo *et al.* review flexible organic-inorganic hybrid perovskite solar cells from solution process.

Research progress has also been made in mechano-responsive materials that can convert mechanical power into electrical energy, chemical changes, or into different colors, which is useful for wearable self-powered mobile electronic systems such as medical sensors or probes. Chen *et al.* introduce the recent advances of mechanoluminescent polymers for flexible smart sensors.

Two research papers about electronics are also included. Yu Wang *et al.* report their result of silver nano-necklaces for flexible ultrasensitive tips by surface-enhanced Raman scattering spectroscopy. Ying Wang *et al.* provide a letter for high efficient inverted organic light-emitting diode. Their technologies show high potential powering by flexible energy devices.

Though different types of flexible energy devices have been proposed and designed, the wide application of them will highly lie on their resistance to impact, durability, portability, bendability and efficiency, especially their good flexibility. Various flexible energy devices will greatly stimulate the development of flexible electronic devices, providing more possibilities for the design of flexible electronic devices.

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