Challenging the 'rigidity' for smart soft electronics

August 3 2016

Soft electronic devices, such as a smartphone on your wrist and a folding screen in your pocket, are looking to much improve your lifestyle in the not-too-distant future. That is, if we could find ways to make electronic devices out of soft organic materials instead of the existing rigid inorganic materials.

Conducting polymers are a promising candidate that could be utilized for these next-generation applications because they are malleable, lightweight, and can conduct electricity, although their charge carrier mobility is intrinsically lower than that of inorganic materials. Various studies therefore have focused on how to boost the speed at which the charge carriers move in conducting polymers. Many researchers have attempted to enhance the charge carrier mobility by increasing polymers' crystallinity, which is the degree of structural order. However, this approach is inherently restrictive in terms of mechanical properties. In other words, an increase in the crystallinity results in a decrease of the mechanical resilience, at least according to the conventional norm.

A team of researchers with the Dept. of Chemical Engineering at Pohang University of Science and Technology (POSTECH), consisting of Profs. Taiho Park and Chan Eon Park with their students Sung Yun Son and Yebyeol Kim, has found a way to solve this dilemma and developed a low crystalline conducting polymer that shows high-field effect mobility. Their findings were recently published as the cover article in the *Journal of American Chemical Society* and highlighted in the Spotlights.

To improve charge transport in a low-crystalline conducting polymer, the researchers took a simple yet unconventional approach. They introduced monomers without side chains into the polymer and utilized unconventional localized aggregates as stepping-stones to expedite charge transport in the microstructure of the polymer. Park et al. found that the resulting increase in the backbone planarity and chain connectivity of the polymer gave rise to enhanced charge transport along and between the polymer chains.

Their findings provide not only a greater understanding of charge transport dynamics in low-crystalline conducting polymers but also a new strategy in molecular design that allows faster charge transport without the loss of mechanical advantages. Taiho Park and Chan Eon Park, the two corresponding authors of this research, anticipate that their study opens up numerous possibilities and will bring forth new research, solutions, and applications for soft electronics.

Provided by Pohang University of Science & Technology (POSTECH)