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n-type conductive polymers as electrical conductor of future printed electronics

Fraunhofer IWS scientists have developed an n-type conductive polymer, which shows an electrical conductivity of more than one order of magnitude higher than conventional n-type conductive polymers. These novel polymers open up completely new perspectives for applications in the field of flexible, organic electronics.

Since the Eighties it has been well known that the electrical conductivity of polymers may approach that of metals. Scientists were awarded with the 2000 Nobel Prize for Chemistry for this technological discovery. There is a decisive difference between polymers and metals: in the case of metals the electrons are responsible for conductivity. In commercially available polymers, however, a load carrier type with a positive elementary charge (p-type conduction) provides the electrical conductivity (e.g., PEDOT:PSS).

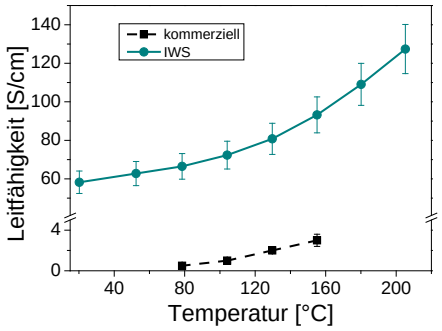
Apart from p-type conductive material, n-type conductive material is necessary for the set-up of most electronic components, however, n-type conductive polymers, developed so far, have neither sufficient conductivity nor are they robust enough in environmental conditions. The n-type conductive polymer, developed by the team "Printing Technology" at the Fraunhofer IWS Dresden, shows an electrical conductivity which is one order of magnitude higher than that of conventional n-type conductive polymers (Fig. 1). By doping it can be increased by another 40 per cent.

In addition, the stability of the polymer in environmental conditions is of excellent quality and already sufficient for numerous applications. After 30 days the conductivity has been merely halved. This is an outstanding result, if one takes into account that conventional non-capsulated n-type conductive polymers already lose their conductivity after a few hours. The high stability of the IWS-developed polymers can be explained by the electron work function of approx. 4.5 eV.

The new material opens up new possibilities for applications in the field of flexible, organic electronics, e.g., in the production of thermoelectric generators, transistors or organic solar cells.

The workshop "Energy Harvesting Systems – FlexTEG", taking place on June 25 – 26, 2015 at the Fraunhofer IWS Dresden will address topics such as materials developments, system design and manufacturing technologies for flexible thermoelectric generators.

Photos



Conductivity of a n-type conducting polymer (non-doped) compared to a commercially available polymer
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Polymer-based, flexible thermoelectric generator for applications at curved surfaces
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