Development of New Semiconductor Paper for Organic Electronics

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Abstract

The use of organic semiconductors in electronic devices offers promising prospects, particularly in terms of significant reductions of weight and manufacturing cost. Nevertheless, these materials have ecological drawbacks issues, not only for the semiconductor polymers synthesis themselves but also because of the materials used as support, non-recyclable, non-biodegradable or from non-renewable sources (plastic or glass).

Our project is part of a new sustainable perspective oriented towards the development of an environmentally friendly process for the synthesis of new semiconductor molecules, polyazomethines, using a simple reaction by condensation of a dialdehyde and a diamine in a green solvent using biomonomers. The biosourced dialdehydes, divanillin and diformylfuran, were synthesized from vanillin and fructose respectively. The first diamine, 4-(4-aminophenoxy)-2-pentadecylaniline, was prepared from cardanol and the second one, 3,4-dimethoxydianiline, derives from acetovanillone.

Post-doping electrical conductivity studies revealed encouraging levels of conductivity. We therefore selected the best-performing polymer for grafting it onto kraft paper via covalent bonding. Paper pulp was chosen because it is an environmentally friendly material derived from renewable and biodegradable resources. The pulp fibers are first oxidized in water before being coupled to the semiconducting polymer, still in water.

Preliminary results show promise and ongoing on optimizing polymer grafting and testing other doping agents to improve electrical conductivity.

Keywords

Organic semiconductors, Bio-based polyazomethines, Renewable monomers, Kraft pulp, Semiconductor paper.