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Sensitive textile fibers

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A sensitive fiber (textile-electronic-fiber or e-fiber) is the first step to design and manufacture sensing and acting textiles. Metal/plasma polymer nanocomposite coatings have already been identified as a suitable type of material for sensor applications. Several plasma-based deposition techniques have been explored in order to incorporate metal nanoparticles into a plasma polymer matrix, e.g. simultaneous magnetron sputtering from metal and polymer targets or metal evaporation during PECVD. Plasma technology offers a controlled film growth at high surface diffusion and low temperatures. However, such coatings are not yet industrialized, also due to low deposition rates and restrictions in deposited area. Also, various applications of the e-fiber sensors (e.g. for sensing of strain or relative humidity) require using different appropriate combination of nanoparticle, polymer and electrode materials and therefore an individual approach. For sensing, a change in resistivity can be recorded near the percolation threshold, e.g. when humidity is entering the plasma polymer matrix of the nanocomposite or due to application of an external force.
In this contribution, we will characterize the deposition process using plasma diagnostics and investigate basic properties of the metal/plasma polymer nanocomposite structures suitable for their application as efficient sensors. In particular, the change in resistivity is recorded for a thin layer of Ag nanoparticles with a filling factor around 0.4 within a hydrophilic plasma polymer network. Different (hydrophilic/hydrophobic) adlayers are also investigated. These films are applied to polyester fibers.

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