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## **Synthesis and characterization of highly conductive, printable and stretchable PEDOT-based materials: applications in thermoelectrics, photovoltaics and transparent flexible heaters.**

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Conducting polymers are promising materials for the production of transparent conducting layers for use in optoelectronics. They have advantages over inorganic materials, such as low cost, easy deposition by printing techniques and high flexibility, but their electrical conductivity needs to be improved to meet the requirements of certain applications. Among conducting polymers, poly(3,4-ethylenedioxythiophene) (PEDOT) is probably one of the most studied and used.<sup>[1]</sup>

We found a simple solution-processing approach for the preparation of poly(3,4-ethylenedioxythiophene) (PEDOT) thin films with conductivity above 6000 S. cm<sup>-1</sup>.<sup>[2-3]</sup> We will show that such an improvement in the conductivity of PEDOT-based materials requires precise control of the water content during the polymerization step.<sup>[3]</sup> XRD, HRTEM, synchrotron GIWAXS analyses and conductivity measurements up to 3 K allowed us to unravel the organization of these highly conductive polymeric materials and their doping and transport mechanisms. We also propose a charge transport model that fully confirms our experimental observations.

In the second part of this talk, we demonstrate the intrinsic stretch ability of thin films of our PEDOT-based materials and show their remarkably high stability. We highlight the factors that alter their structure, which in turn degrades electrical performance.<sup>[4-5]</sup> Finally, we will show that our PEDOT materials exhibit not only high conductivities, but also high transmittance in the visible range, up to 96% at 550 nm. We will then show that PEDOT materials can be used to fabricate transparent all-polymer heating films,<sup>[6]</sup> thermoelectric devices,<sup>[7]</sup> and for the replacement of platinum in the counter-electrodes of photochromic dye-sensitized solar cells.<sup>[8]</sup>

### **References**

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