Polypyrrole/Carbide-derived carbon-based electroactive hybrid films for bending and diametrically expanding actuators

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Despite the fact that electroactive materials based on conducting polymers have attracted noticeable attention during the last two decades, a further development is still required especially with regards to strain, speed, efficiency and stability. Here we demonstrate successful incorporation of highly porous carbon in a conductive polymer (polypyrrole) matrix in order to prepare actuators with diametrical- and bending strain properties with increased the actuation efficiency. Polypyrrole/Carbide-derived carbon (PPy(DBS)CDC) composites were prepared by an in-situ synthesis of nanoporous carbide-derived carbon powder and pyrrole monomers using simple electrochemical polymerization. This one-step electrochemical synthesis method provides supplementary, simple and efficient alternative for current tape-casting and inkjet printing technologies to produce carbon powder-based electroactive composites. In electroactive films the polypyrrole assists as highly conductive and electromechanically active binder to support the electromechanical actuation. The maximum diametrical strain of the hybrid PPy(DBS)CDC film increased tenfold compared to pure CDC film with nonconductive polymer binders. Although, the overall thickness change of hybrid material was slightly lower compared to PPy(DBS) films, the PPy(DBS)CDC hybrid films demonstrated a doubled efficiency (swelling per charge inserted).

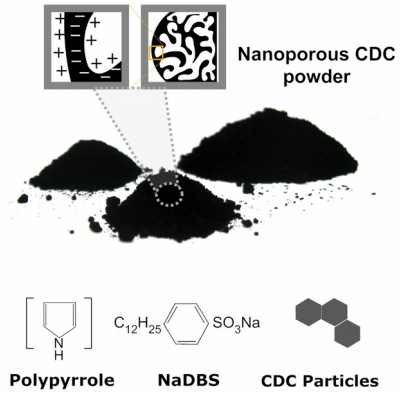

Figure 1: PPy(DBS)CDC

References

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