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MORPHOLOGICALLY DESIGNED NOVEL NANOCARBON MATERIALS DERIVED FROM HIGHLY STABLE SWCNT INKS

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Nanoporous carbon consists of nanoscale disordered graphene units and also has a relatively high electrical conductivity. When ions are confined in the extremely narrow carbon nanopores, they induce image charges on defective carbon walls, thus reducing the ion-ion Coulomb repulsion [1]. This effect provides new insight into high-performance supercapacitors [2].

There is need for an efficient dispersant that would separate bundled SWCNTs. We have developed a Zn-Al sol-gel dispersant [3] as an alternative to widely used surfactants. The Zn-Al dispersant can be more easily removed from SWCNTs than surfactants. Then, we can uniformly deposit SWCNTs on PET [4] and flexible glass [5], resulting in a highly conductive film with transparency in the near UV region in the range of 80–90% that is temperature independent up to ≈600 K. The thermal stability of the SWCNT film on flexible glass exceeds that of ITO [5]. Our approach provides also SWCNT inks capable of forming free-standing SWCNT films, which give an excellent support for Pt nanoparticles used in fuel cells and SWCNT nets [6].

The Zn-Al dispersant enables to prepare stress sensors based on creased SWCNTs encapsulated in polydimethylsiloxane (PDMS) with non-fluorinated water-repellant coating. The compact design and superior water resistance of the sensor, along with its appealing linear response and large strechability, demonstrates the scalability of such sensors applications [7]. These sensors may be combined with flexible electrodes operating in aqueous environment.

References

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