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Influence of Hydrophilicity on the Hydrovoltaic Power Generation from Carbon Nanoparticles

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Water is the largest carrier of energy on the Earth, but negligible amount of this energy has been harnessed. This has prompted researchers to explore the Hydrovoltaic effect, which refers to the generation of electricity from the interaction of water with nanostructured surfaces. Nanoporous materials show promising performance in this regard due to their ability of spontaneous imbibition of fluids. In this vein, most of the research on carbon-based materials focusses on 2D-materials like carbon-black, graphene and its derivative materials. In this talk, electricity generation from the ambient evaporation of water using a hermetically sealed Hydrovoltaic cell comprised of porous carbon nanoparticles will be discussed; along with the influence of surface hydrophilicity of these carbon nanoparticles on the power generation. The primary advantage of hermetic Hydrovoltaic cell being the insulation from environmental conditions that it provides. In addition, the nitric acid treatment of carbon nanoparticles improved their hydrophilicity and increased their O-atom content. Moreover, the morphology and mesoporous nature of carbon nanoparticles was largely preserved during acid treatment. However, a general decreasing trend in the BET surface area was observed in the samples as the concentration of nitric acid was increased. The increment in the O-content from 3% to 20% resulted in the enhancement of Hydrovoltaic voltage generation by up to 125%. The hermetically sealed device was able to provide a steady maximum voltage output of 450 mV for a period of 48 hours. The voltage output can be further enhanced by connecting several such devices in series. These findings provide an avenue for exploiting low-grade ambient heat for electricity generation

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