Nano-graphite functionalized mesocellular carbon foam with enhanced intra-penetrating electrical percolation networks for high performance electrochemical energy storage electrode materials

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Mesocellular carbon foam (MSU-F-C) is functionalized with hollow nanographite by a simple solution-phase method to enhance the intrapenetrating electrical percolation network. The electrical conductivity of the resulting material, denoted as MSU-F-C-G, is increased by a factor of 20.5 compared with the pristine MSU-F-C. Hollow graphite nanoparticles are well-dispersed in mesocellular carbon foam, and the d spacing of the (002) planes is 0.343 nm, which is only slightly larger than that of pure graphite (0.335 nm), suggesting a random combination of graphitic and turbostratic stacking. The MSU-F-C-G electrode exhibited a very high area capacitance compared with that of the MSU-F-C electrode, which is attributed to the enhanced intraparticle conductivity by the nanographitic functionalization. When applied as an anode in a lithium ion battery, a significant increase in the initial efficiency, high reversible discharge capacity in the lower voltage region, and a higher rate capability were observed. The high rate capability of the MSU-F-C-G electrode as charge storage was due to the low resistance derived from the nanographitic functionalization.