A facile synthesis of pitch-based carbon microbeads and its superior performance for sodium-ion batteries

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In recent years, soft carbon has been widely investigated as the anode material in sodium-ion batteries (SIBs) due to its low-cost and excellent comprehensive performance. Soft carbon exhibits more superior rate performance compared to hard carbon, but it usually possesses lower reversible capacity, commonly in the range of 100-250 mA h g^{-1}. So how to improve the reversible capacity of soft carbon is a research priority. In this work, we prepared pitch-based carbon microbeads (PCMB) by emulsion method using pristine pitch as raw material in the air atmosphere. In the emulsion system, the pitch spheres were formed by emulsification, and simultaneously, their surface got cured due to oxidation linking in the air. Unlike mesophase carbon microbeads (MCMB) generated from liquid carbonization, the existence of oxygen-containing groups obstructed the rearrangement of carbon layers, leading to a more disordered graphite crystallites structure and more lattice defect, which contributes high reversible capacity (313mA h g^{-1} at 50mA g^{-1}) and high initial coulombic efficiency (72.6%). Meanwhile, it also exhibits superior rate performance (reversible capacities are retained at 179 mA h g^{-1} and 106 mA h g^{-1} at current densities of 1 mA g^{-1} and 2 mA g^{-1} respectively). Therefore, the PCMB would be a promising anode material for SIBs.