A novel strategy of nano-copper-assisted immobilizing S in microporous carbon (MC-Cu-S) cathode for room temperature Na-S batteries was presented in this study. The unique structural composite cathode containing 50% S shows stable and high reversible capacities, together with remarkable rate and cycling capabilities. For instance, the Na-S cells maintain capacities of around 610 mAh/g with Coulombic efficiency close to 100% in 110 cycles at the current density of 50 mA/g, and can provide a capacity of 100 mAh/g even at a high rate of 5.0 A/g.

The structural properties of the MC-Cu-S composite were characterized by XRD, TGA, SEM, EDS and HRTEM. The exceptional performance of MC-Cu-S cathode is because: (i) Cu nanoparticles chemically stabilize S by formation of solid Cu polysulfide clusters through strong interaction between Cu and S; (ii) Cu nano-inclusins enhance the electronic conductivity of MC-Cu-S cathodes; (iii) MC host provides free space for volume change of S/polysulfides. The results represent that small amount of metal nanoparticle anchored in MC can substantially stabilize the S cathode, increasing the S loadings and improving the cycling stability and rate capability.

Keywords: Li-ion, Li-S battery, Nanocomposite.