

Composite cathodes containing γ -sulfur and reduced graphene oxide for lithium–sulfur batteries

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Composite cathodes S@rGO were obtained by long-term exposure of the mixture of rGO and sulfur above the melting point of sulfur (melt-infiltration method). For this purpose, rGO was mixed with sulfur in a mass ratio of ~1:3.5 and sealed in a reactor with a Teflon liner in a glove box filled with argon. The reaction was carried out at 155 °C for 10 h followed by natural cooling.

IR spectra were registered on a Nicolet iS5 FTIR spectrometer (Thermo Fisher Scientific, USA) using an attenuated total reflection attachment with a diamond crystal. Phase composition of the prepared materials was analyzed by X-ray diffraction (XRD) using a Rigaku D/MAX 2200 diffractometer (CuK α radiation) and FullProf Suit software. The morphology of the samples was analyzed using a scanning electron microscope (SEM) Tescan Amber GMH (Tescan, Czech Republic) equipped with an AZtec system (Oxford Instruments) for energy-dispersive X-ray spectroscopy (EDX) data analysis. The low-temperature nitrogen adsorption isotherms were measured using a Sorbtometer-M analyzer (JSC “Katakon”, Russia) at -196 °C. Carbon content was measured using a EuroEA3000 elemental analyzer (EuroVector, Italy).

The conductivity of rGO and S@rGO was investigated by impedance spectroscopy. The measurements were carried out using an impedance meter Elins Z-1500J (LLC “Elins”, Russia) in the frequency range of 2 MHz - 10 Hz on powders pressed at a pressure of 1.5 tons in the directions parallel and perpendicular to the pressing axis.

Electrochemical cells contained a working (S@rGO), lithium auxiliary and lithium reference electrode. The electrolyte used was 1 M LiTFSI (Li(CF₃SO₂)₂N) in a DO-DME mixture (1:1 v/v). All reagents were Battery grade. The water content in the electrolyte measured with a 917 Coulometer titrator (Metrohm, Switzerland) did not exceed 15 ppm. Assembly of electrochemical cells was carried out in a glove box (JSC “Spectroscopy Systems”, Russia) with a dry argon atmosphere. The water and oxygen content in the box did not exceed 5 ppm. Galvanostatic curves were recorded using a potentiostat-galvanostat P-20X8 (LLC “Elins”, Russia). The amount of active mass on the electrode was about 5 mg/cm².

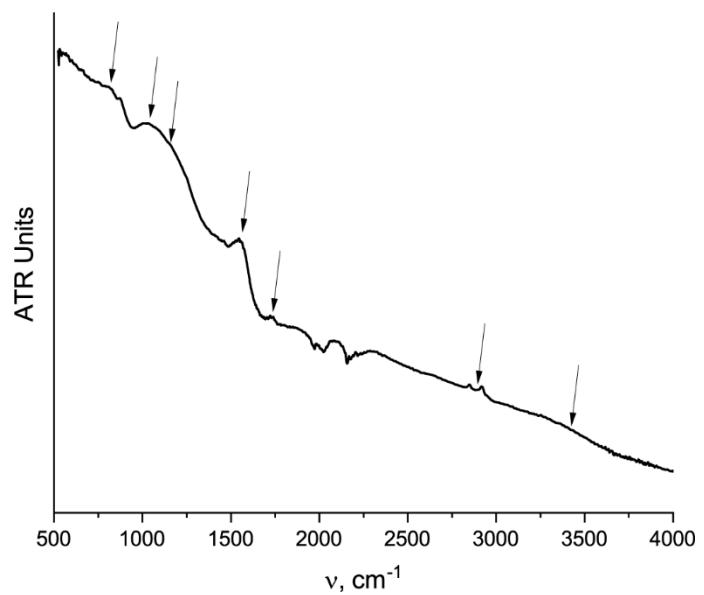


Figure S1. IR spectrum of rGO.