

## *Supporting Information*

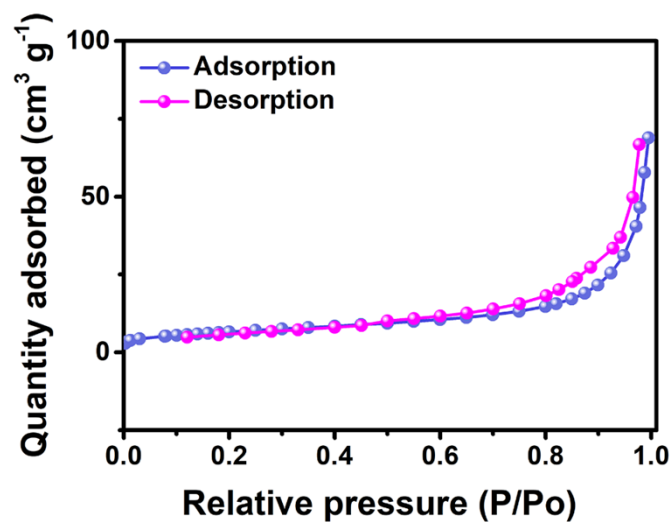
### **3D embroidered ball-like $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> synthesised by microwave hydrothermal as sulfur immobilizer for high performance Li-S batteries**

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**Fig. S1**The N<sub>2</sub> adsorption isotherm of  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>/GO-25 composite.

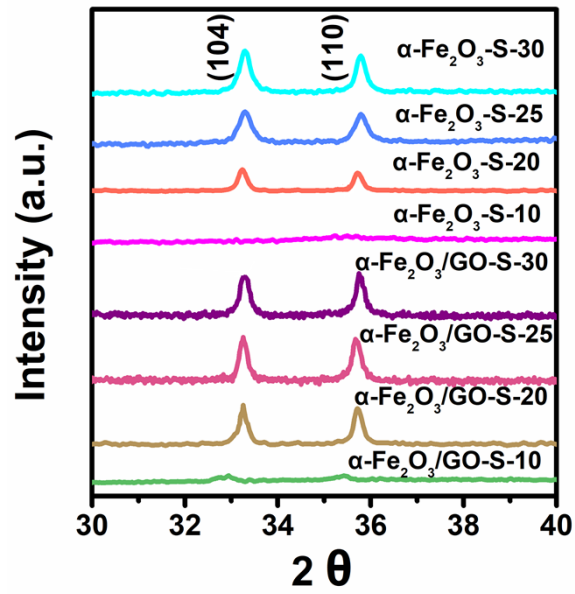


Fig. S2 XRD patterns.

Table S1. Values of different samples.

Sample	Ratio	Sample	Ratio
$\alpha\text{-Fe}_2\text{O}_3\text{-S-20}$	0.85	$\alpha\text{-Fe}_2\text{O}_3/\text{GO-S-20}$	1.03
$\alpha\text{-Fe}_2\text{O}_3\text{-S-25}$	0.87	$\alpha\text{-Fe}_2\text{O}_3/\text{GO-S-25}$	1.08
$\alpha\text{-Fe}_2\text{O}_3\text{-S-30}$	0.88	$\alpha\text{-Fe}_2\text{O}_3/\text{GO-S-30}$	1.09

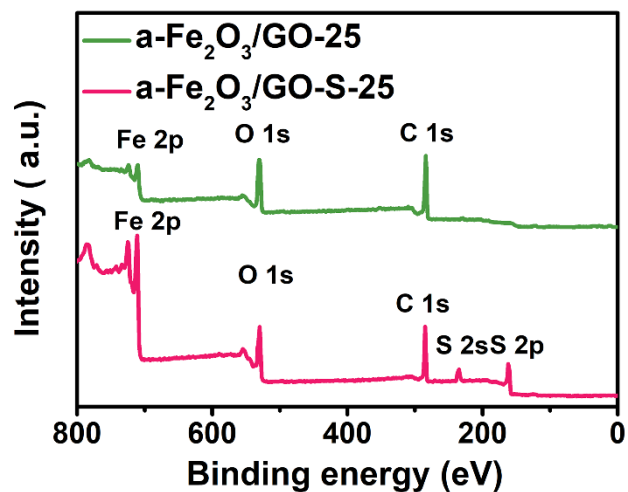


Fig. S3 XPS survey spectra of  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>/GO-25 and  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>/GO-S-25 composites.

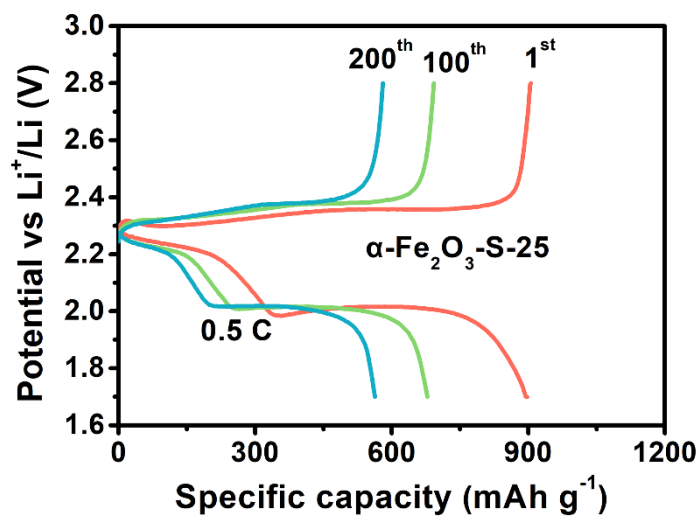


Fig. S4 Galvanostatic charge/discharge profiles of  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>-S-25 after 200 cycles.

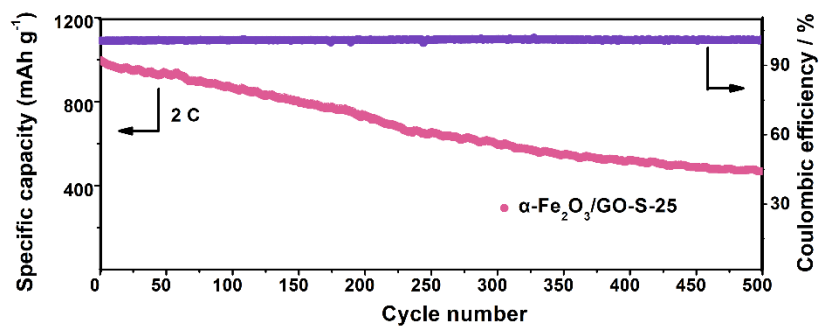


Fig. S5 Cycling performance of  $\alpha\text{-Fe}_2\text{O}_3/\text{GO-S-25}$  electrode at 2 C after 500 cycles.

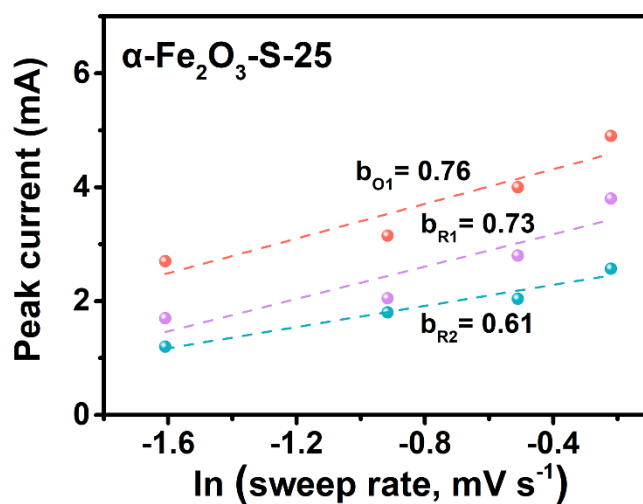


Fig. S6 The correspond fitted lines of  $\alpha\text{-Fe}_2\text{O}_3\text{-S-25}$  electrodes at different scan rate.

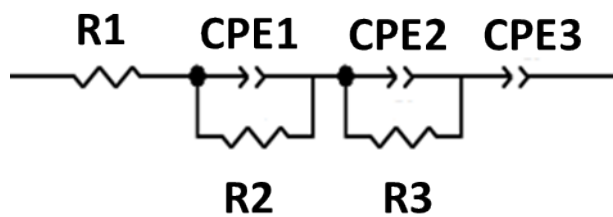


Fig. S7 The equivalent circuit diagram of  $\alpha\text{-Fe}_2\text{O}_3/\text{GO-S-25}$  electrode.

Table S2. Rct ( $\Omega$ ) values of different electrodes.

Sample	Rct ( $\Omega$ )	Sample	Rct ( $\Omega$ )
$\alpha$ -Fe <sub>2</sub> O <sub>3</sub> -S-10	87.5	$\alpha$ -Fe <sub>2</sub> O <sub>3</sub> /GO-S-10	58.3
$\alpha$ -Fe <sub>2</sub> O <sub>3</sub> -S-20	79.0	$\alpha$ -Fe <sub>2</sub> O <sub>3</sub> /GO-S-20	42.8
$\alpha$ -Fe <sub>2</sub> O <sub>3</sub> -S-25	63.1	$\alpha$ -Fe <sub>2</sub> O <sub>3</sub> /GO-S-25	17.2
$\alpha$ -Fe <sub>2</sub> O <sub>3</sub> -S-30	66.2	$\alpha$ -Fe <sub>2</sub> O <sub>3</sub> /GO-S-30	21.9

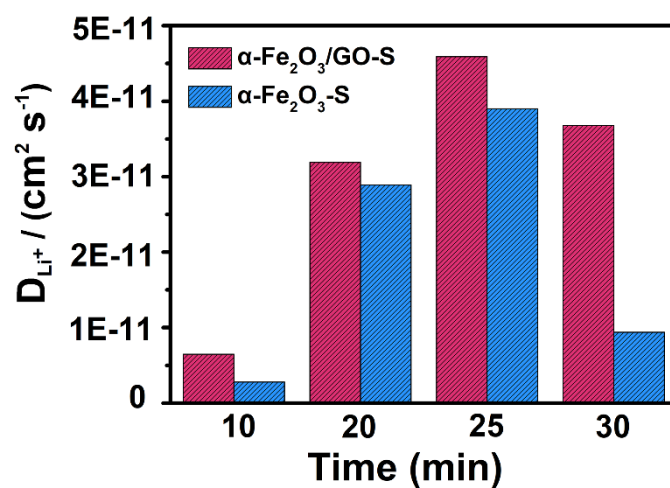


Fig. S8 The calculated  $D_{Li^+}$  values obtained from EIS tests for  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>-S and  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>/GO-S electrodes.