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石墨烯负载的氧配位钴单原子稳定金属锂负极

石浩东[1,2,3]，李亚光[1,2]，路鹏飞[1,2]，吴忠帅[1,2,*]

[1] 中国科学院大连化学物理研究所，催化基础国家重点实验室，辽宁 大连 116023

[2] 中国科学院洁净能源创新研究院，辽宁 大连 116023

[3] 中国科学院大学，北京 100049

Single-Atom Cobalt Coordinated to Oxygen Sites on Graphene for Stable Lithium Metal Anodes

Haodong Shi[1,2,3], Yaguang Li[1,2], Pengfei Lu[1,2], Zhong-Shuai Wu[1,2*]

[1] State Key Laboratory of Catalysis, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian 116023, Liaoning Province, China.

[2] Dalian National Laboratory for Clean Energy, Chinese Academy of Sciences, Dalian 116023, Liaoning Province, China.

[3] University of Chinese Academy of Sciences, Beijing 100049, China.

[*]Corresponding author. Email: wuzs@dicp.ac.cn; Tel.: +86-411-82463036.

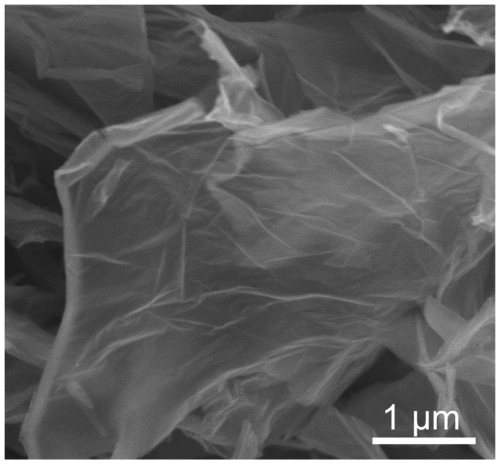

Fig. S1 SEM image of Co-O-G SA.

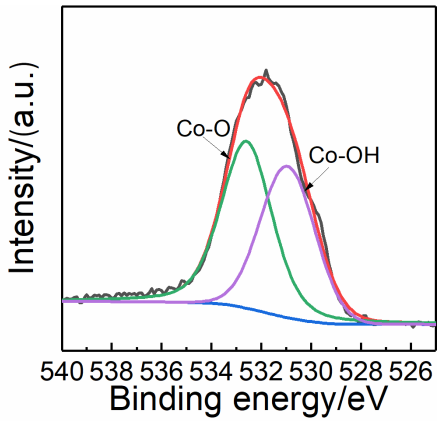

Fig. S2 High resolution O 1*s* XPS spectrum of Co-O-G SA.

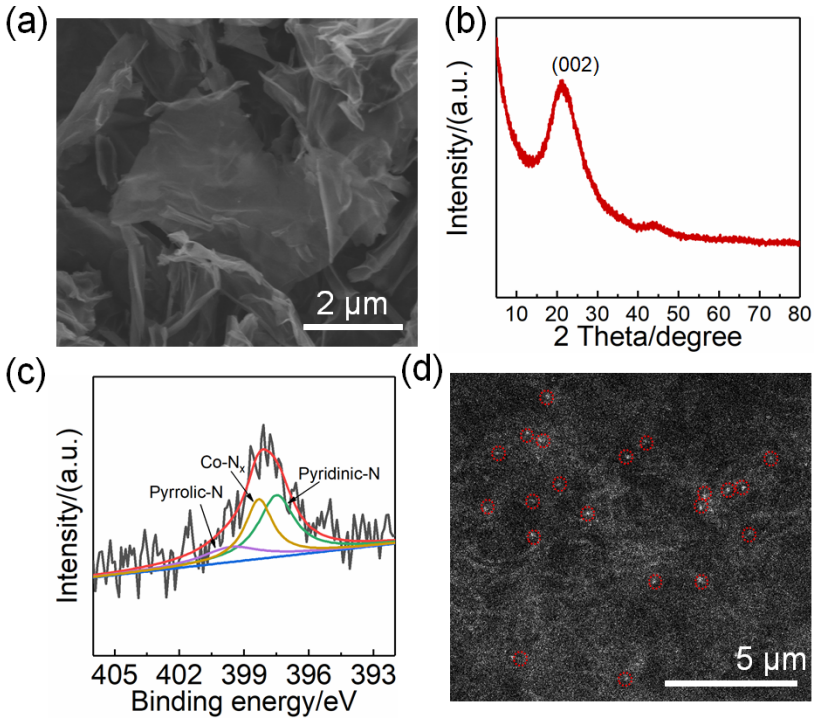

Fig. S3 Characterizations of the as-prepared Co-N-G SA. (a) SEM image, and (b) XRD pattern of Co-N-G SA. (c) High resolution N 1s XPS spectrum of Co-N-G SA.

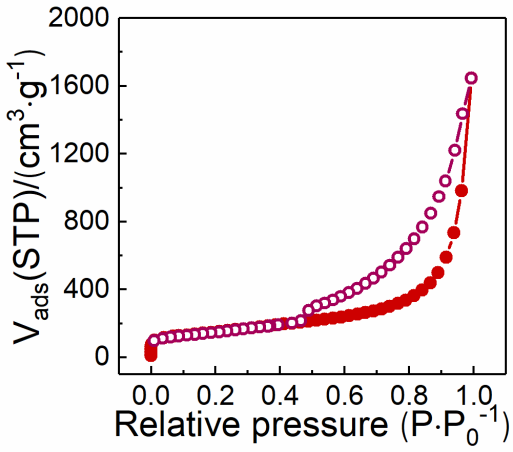

Fig. S4 Nitrogen adsorption-desorption isotherm of Co-N-G SA.

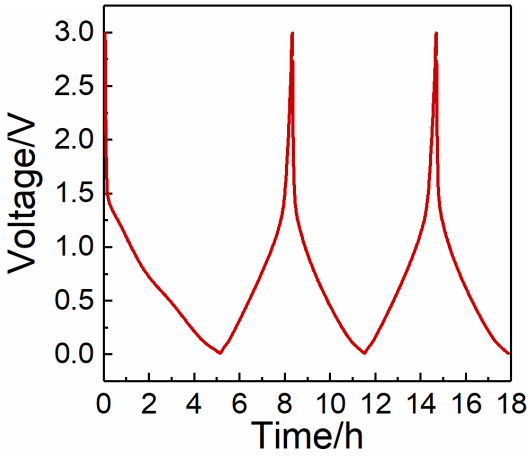

Fig. S5 Typical voltage profiles of Co-O-G SA electrode obtained at the initial 3 cycles. The first 3 cycles at 0.01–3 V was set to Li intercalation and stabilize the SEI film.

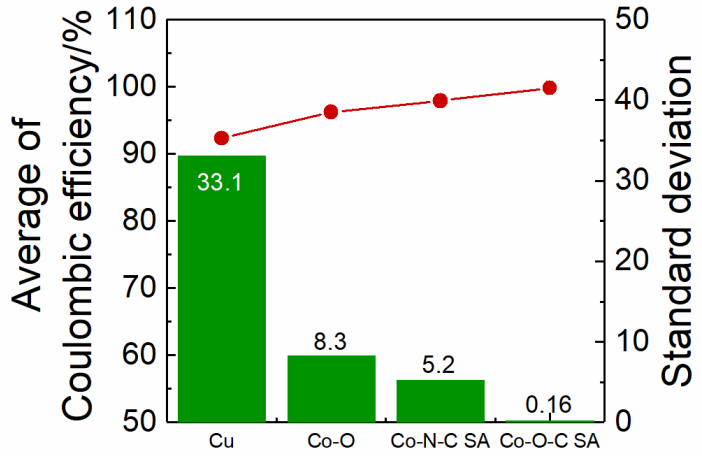

Fig. S6 The average Coulombic efficiencies and their corresponding standard deviations of Co-O-G SA, Co-N-G SA, G-O and Cu electrodes with Li deposition amount of 0.5 mAh cm^{-2} at 0.5 mA·cm^{-2}.

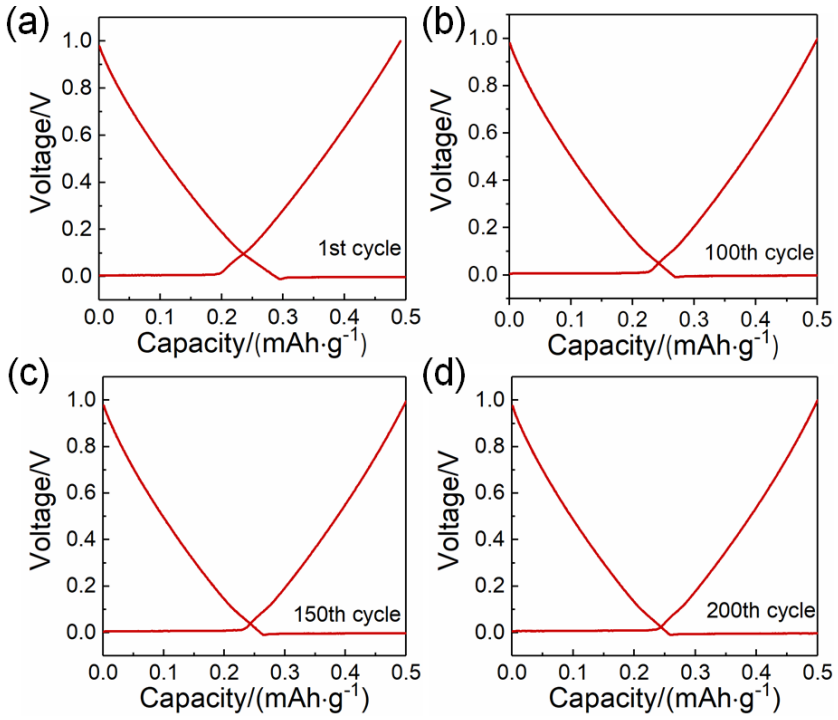

Fig. S7 Voltage profiles of Co-O-G SA electrodes tested at different cycles. Planting 0.5 mAh·cm^{-2} of Li at a current density of 0.5 mA·cm^{-2} at (a) 1st cycle, (b) 100th cycle, (c) 150th cycle, and (d) 200th cycle.

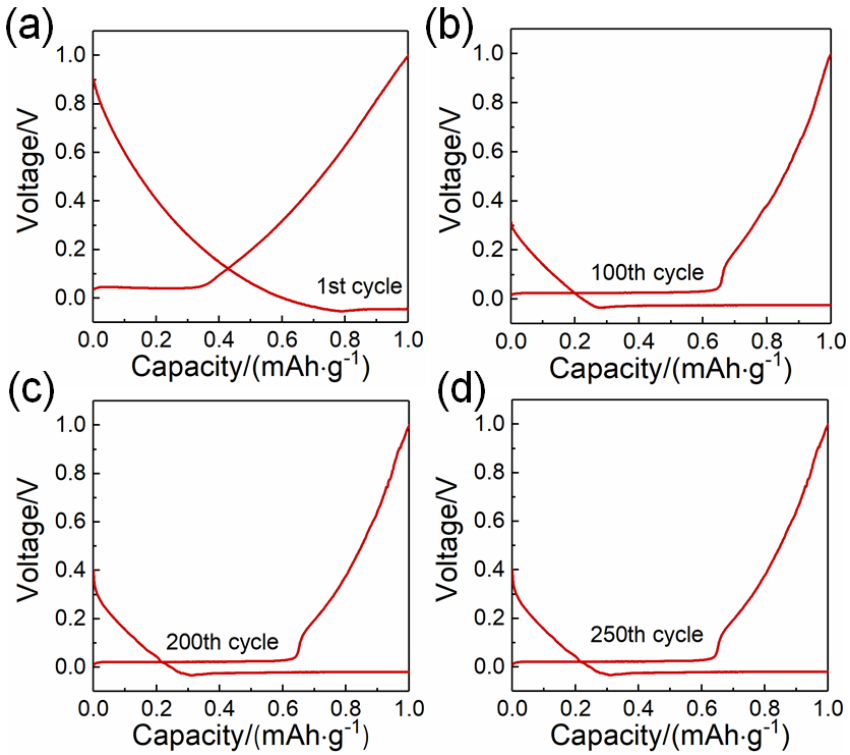

Fig. S8 Voltage profiles of Co-O-G SA electrodes tested at different cycles. Planting 1 mAh cm^{-2} of Li at a current density of 1 mA·cm^{-2} at (a) 1st cycle, (b) 100th cycle, (c) 200th cycle, and (d) 250th cycle.

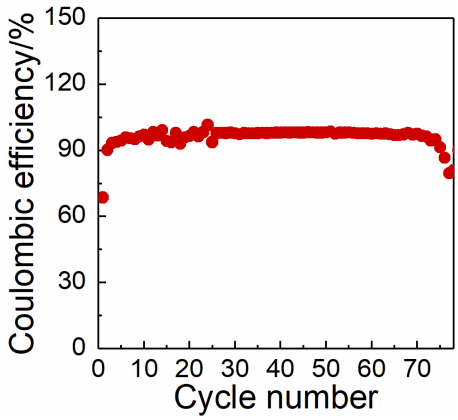

Fig. S9 The Columbic efficiency of Co-O-G SA electrode obtained at 1 mA·cm^{-2} with 1 mAh cm^{-2} with a low mass loading of 0.2 mg cm^{-2}.

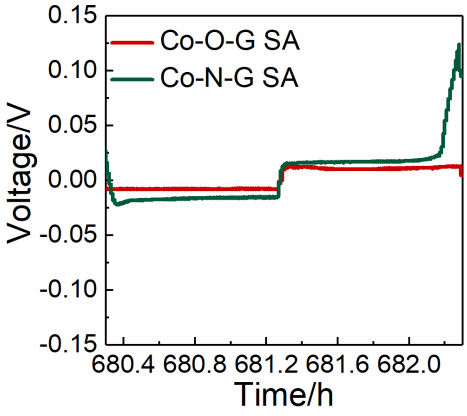

Fig. S10 Detailed voltage profiles of Co-O-G SA/Li and Co-N-G SA/Li symmetric cells at current density of 1 mA·cm^{-2} under stripping/plating capacity of 1 mAh·cm^{-2}.

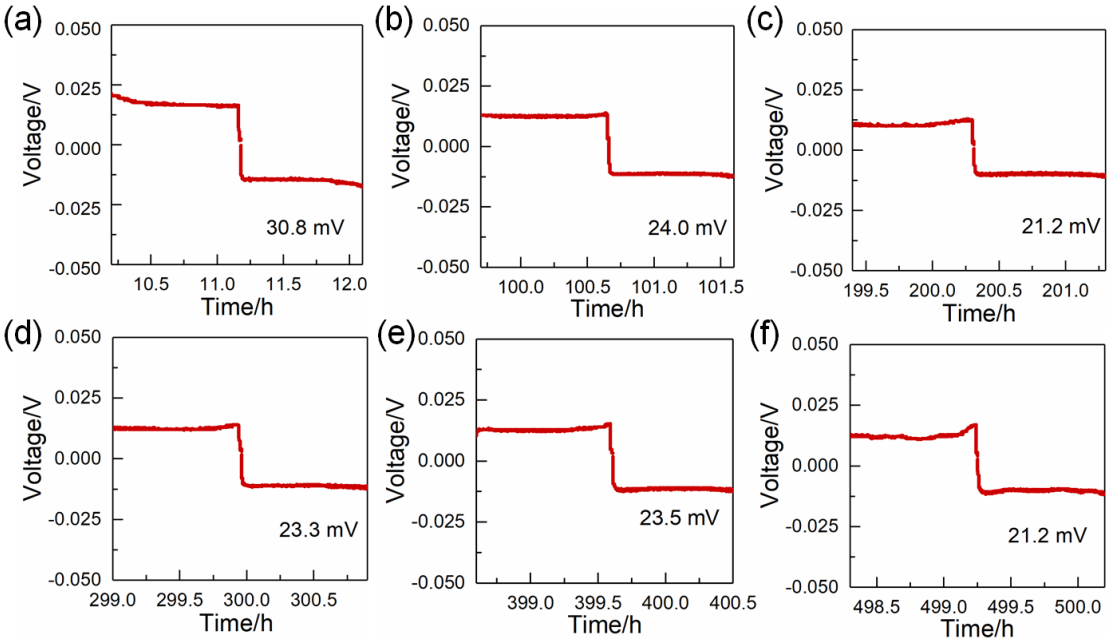

Fig. S11 Detailed voltage profiles of Co-O-G SA/Li symmetric cells at current density of 3 mA·cm^{-2} under stripping/plating capacity of 3 mAh·cm^{-2}.

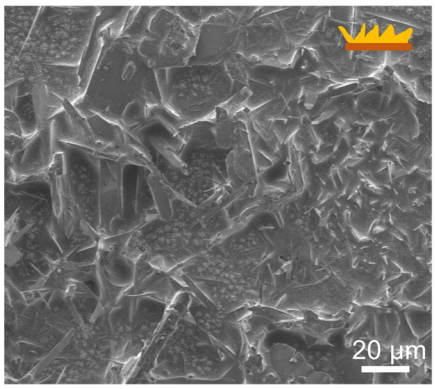

Fig. S12 Top view SEM image of Co-N-G SA electrode at the stage of plating Li with capacity of 1 mAh·cm^{-2}.

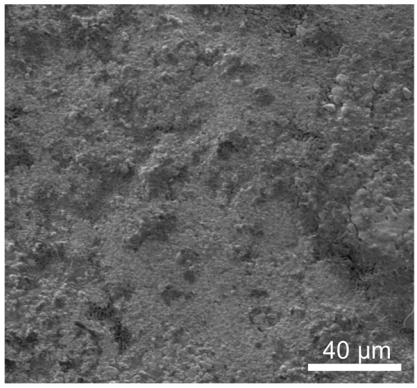

Fig. S13 Top-view SEM image of Co-O-G SA electrode after 250 cycles with a deposition capacity of 1 mAh·cm^{-2} at 1 mA·cm^{-2}.

Table S1 EXAFS fitting parameters of Co-O-G SA.

Sample	Path	CN	R/(Å)	σ^2/(10^{-3} Å^2)	ΔE_0/(eV)	R-factor
Co-O-G	Co-O	3.9 ± 0.2	2.06 ± 0.01	6.0 ± 0.6	1.7 ± 0.4	0.004
	Co-OH	2.0 ± 0.2	2.11 ± 0.01			

Table S2 Electrochemical performance comparison with the recent publications in single atom-based Li anode.

Materials	Current density/(mA·cm^{-2})	Areal capacity/(mAh·cm^{-2})	Cycle time	Ref.
single-atom Zn	1	2	~1050 h	1
S-doped G	1	2	240 h	2
Zn-MXene	1	1	1200 h	3
SANi-NG	1	2	560 h	4
CoN_x-doped graphene	10	2	800 h	5
Co-O-G SA	**8**	**8**	**1300 h**	**This work**

G: graphene; SANi-NG: Atomically dispersed Ni on N doped graphene.

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