

Supporting Information

**Electrodeposition of crystalline silicon directly from silicon tetrachloride in ionic liquid at low temperature**

*Junling Zhang, Shimou Chen, Haitao Zhang, Xue Yao, Zhaohui Shi and Suojiang Zhang\**

*Beijing Key Laboratory of Ionic Liquids Clean Process, Key Laboratory of Green Process and Engineering, State Key Laboratory of Multiphase Complex Systems, Institute of Process Engineering, Chinese Academy of Sciences, Beijing 100190, China*

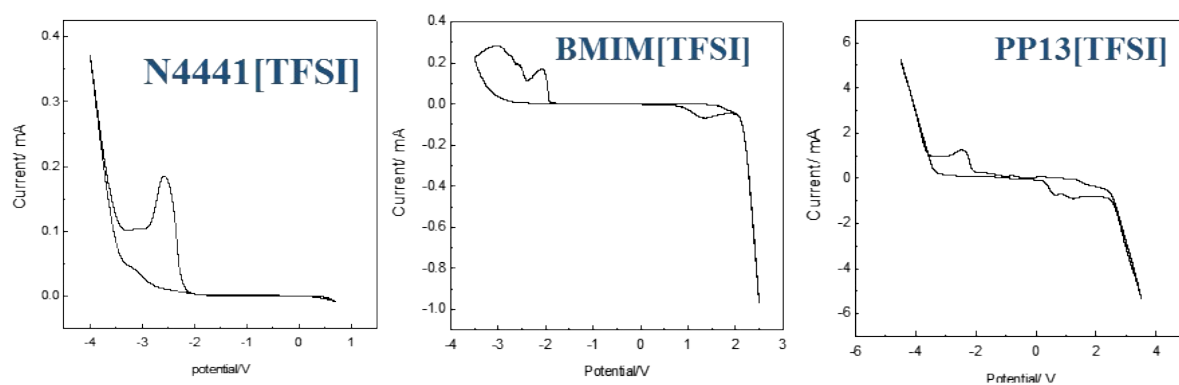
\*Corresponding author: [sjzhang@ipe.ac.cn](mailto:sjzhang@ipe.ac.cn)

**Table S1** Comparison of the viscosity of ILs consisting of EMIM cation and different anions (25 °C, 0.1M Pa)

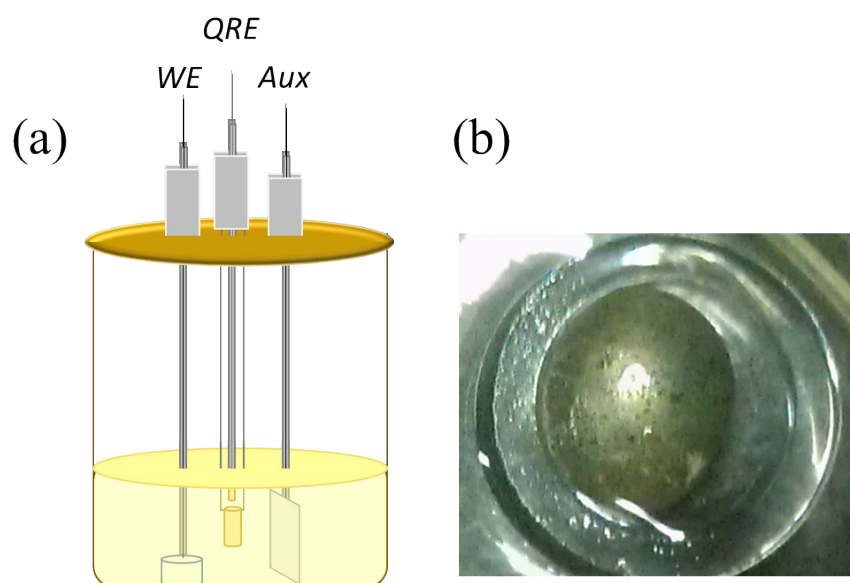
Ionic liquids	$\eta$ (mPa·s)	Testing instrument	Ref.
EMIM PF <sub>6</sub>	450	Cole-Parmer 98936 viscometer	[S1]
EMIM BF <sub>4</sub>	219	Cole-Parmer 98936 viscometer	[S1]
EMIM TFO	76.9	Anton Paar SVM-3000	[S2]
EMIM SCN	54	--	[S3]
EMIM TFSI	50.7	Micro Ubbelohde viscometers	[S4]
EMIM DCA	37	Ubbelohde viscosimeter AVS-440	[S5]

**Table S2** Comparison of the viscosity of [N<sub>4441</sub>][TFSI] measured in this work with literature values (0.1M Pa)

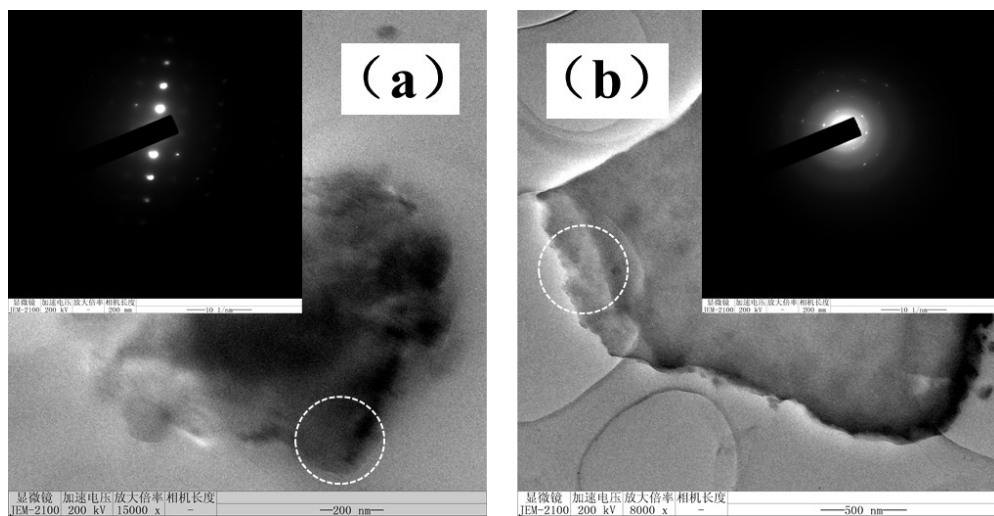
Temperature (°C)	$\eta$ (mPa·s)		Ref.
	This work	Literature	
25	577.9	–	
30	–	386	[S6]
50	114.1	–	
60	64.8	–	
80	30.6	–	



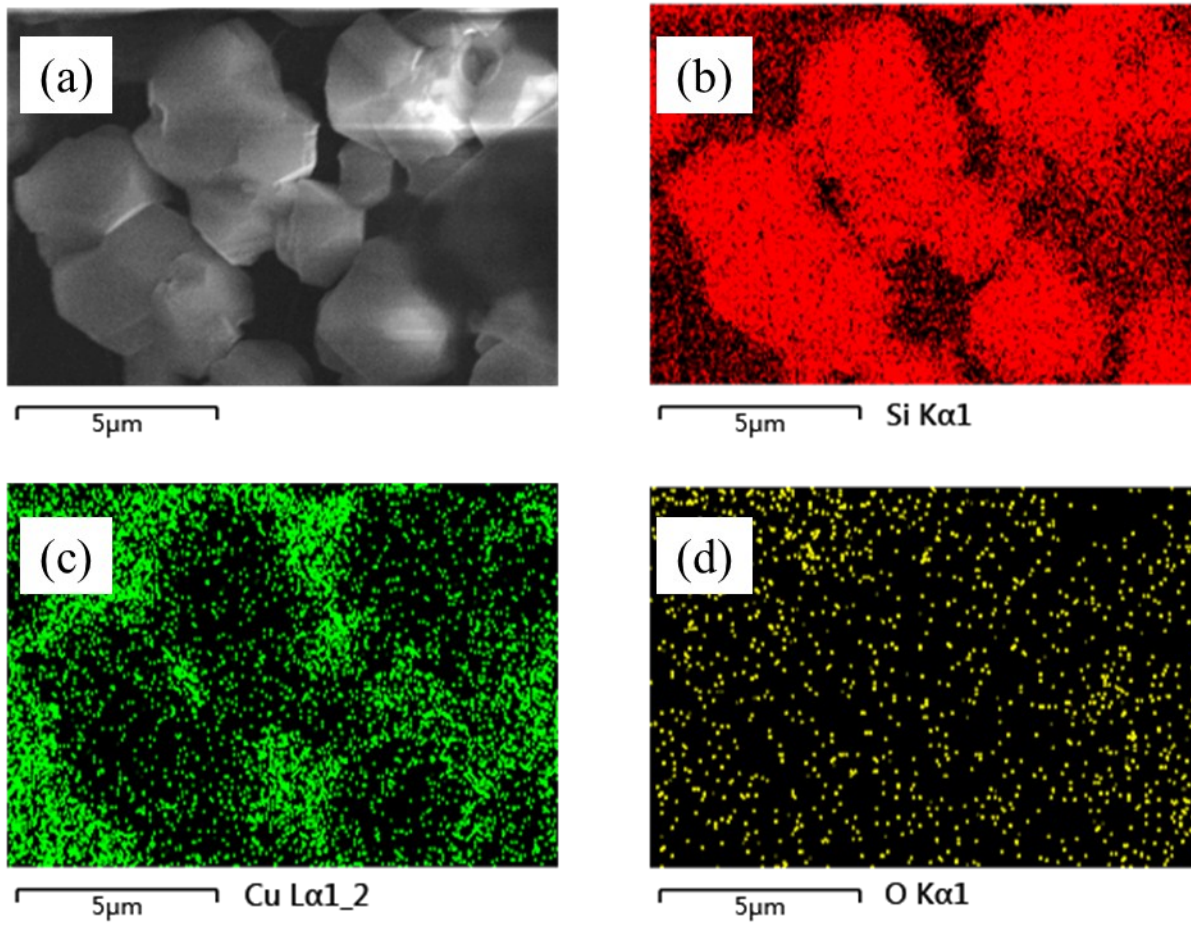
**Fig. S1** CV curves of  $\text{SiCl}_4$  in three different ionic liquids on copper electrode as indicated



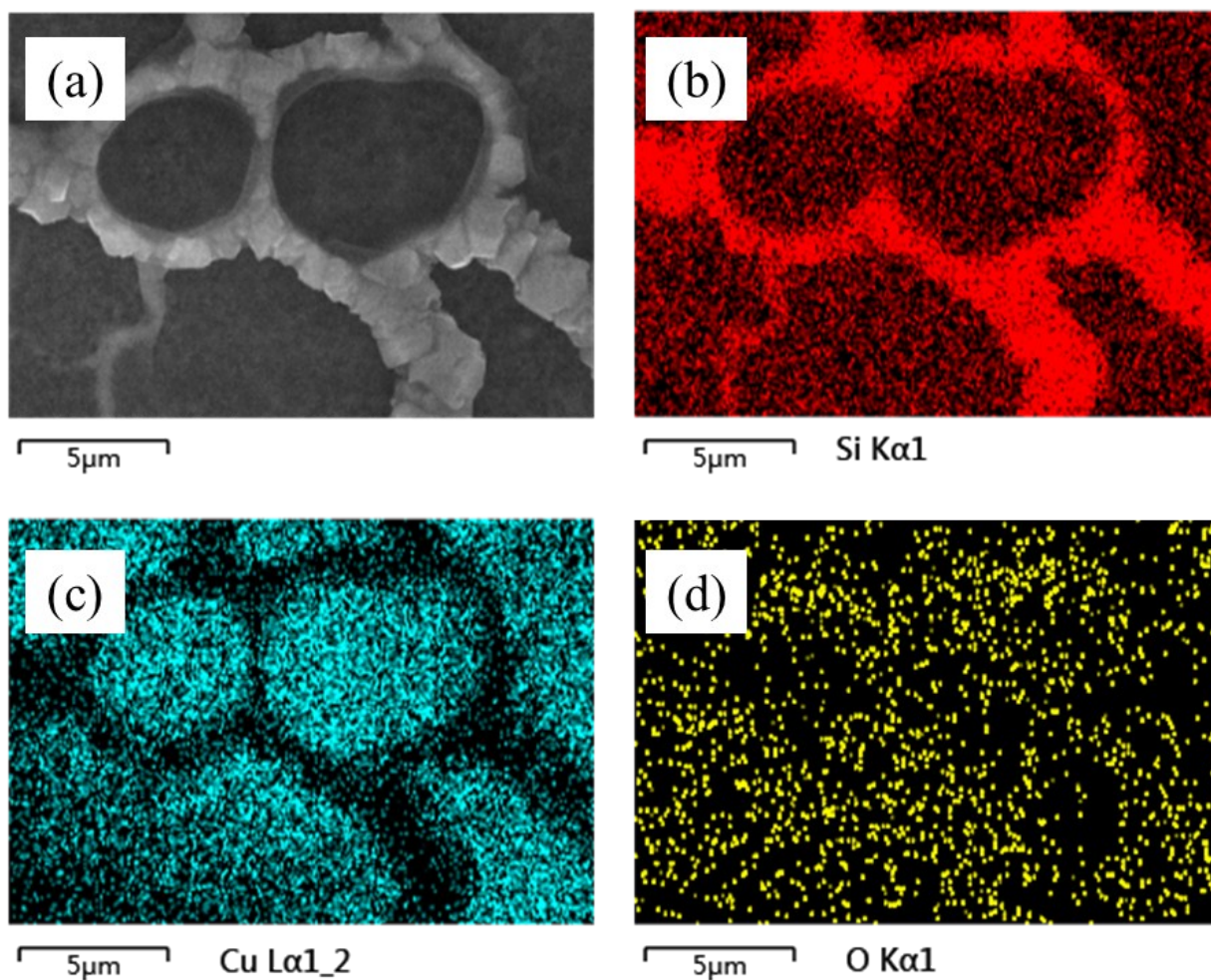
**Fig. S2** (a) Schematic illustration of electrodeposition experiments and (b) Ga electrode with deposited silicon



**Fig. S3** TEM and SAED images of (a) the particle side and (b) film side of the deposits prepared at -2.3 V (vs. Ag QRE) at 100 °C for 2 h

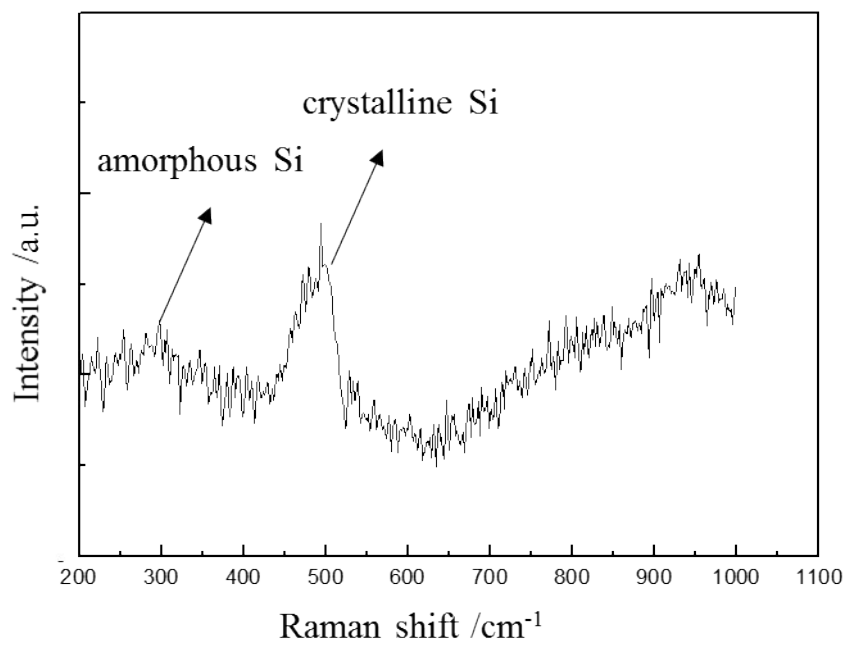


**Fig. S4** (a) SEM and corresponding EDS elemental (b, Si; c, Cu; d, O) mapping images of the Si deposited on static Ga (*l*) electrode at -2.3 V (*vs.* Ag QRE). The Cu as conductive adhesive for SEM test

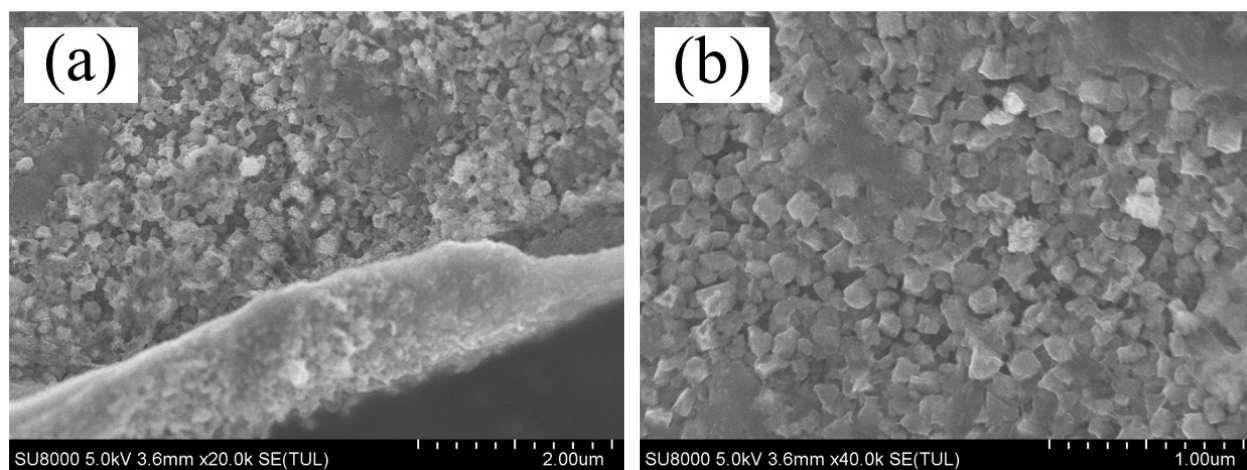


**Fig. S5** (a) SEM and corresponding EDS elemental (b, Si; c, Cu; d O) mapping images of the Si deposited on disturbed Ga (*l*) electrode at -2.3 V (*vs.* Ag QRE). The Cu as conductive adhesive for SEM test





**Fig. S6** Raman spectrum of the as-prepared Si



**Fig. S7** SEM images with different magnifications of the deposits prepared on the liquid metal electrode in the IL of [PP<sub>13</sub>][TFSI]. Crystalline Si grown at a potential of -2.1 V (vs. Ag QRE) at 100 °C for 8 h

References:

1. J. G. Huddleston, A. E. Visser, W. M. Reichert, H. D. Willauer, G. A. Broker and R. D. Rogers, *Green Chem.*, 2001, **3**, 156.
2. M. Shamsipur, A. A. M. Beigi, M. Teymouri, S. M. Pourmortazavi and M. Irandoust, *J. Mol. Liq.*, 2010, **157**, 43.
3. D. Y. Xing, N. Peng and T. S. Chung, *Ind. Eng. Chem. Res.*, 2010, **49**, 8761.
4. A. E. Andreatta, A. Arce, E. Rodil and A. Soto, *J. Solution Chem.*, 2010, **39**, 371.
5. I. Bandres, B. Giner and I. Gascon, *J. Phys. Chem. B*, 2008, **112**, 12461.
6. P. Y. Chen and C. L. Hussey, *Electrochim Acta*, 2004, **49**, 5125.