Supplementary Information

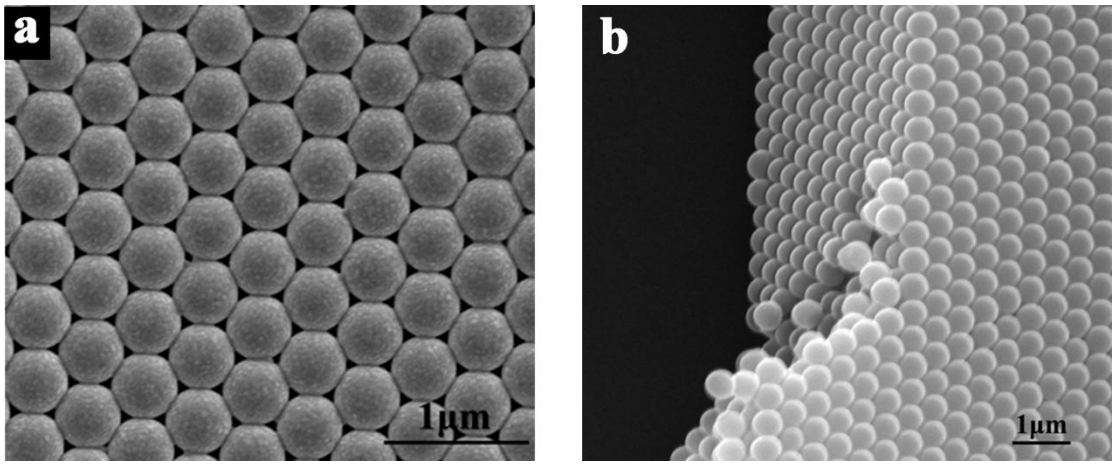

Fig S1 a top-down SEM image of PS template. b. cross-sectional SEM of PS template (with diameter of 440 nm).

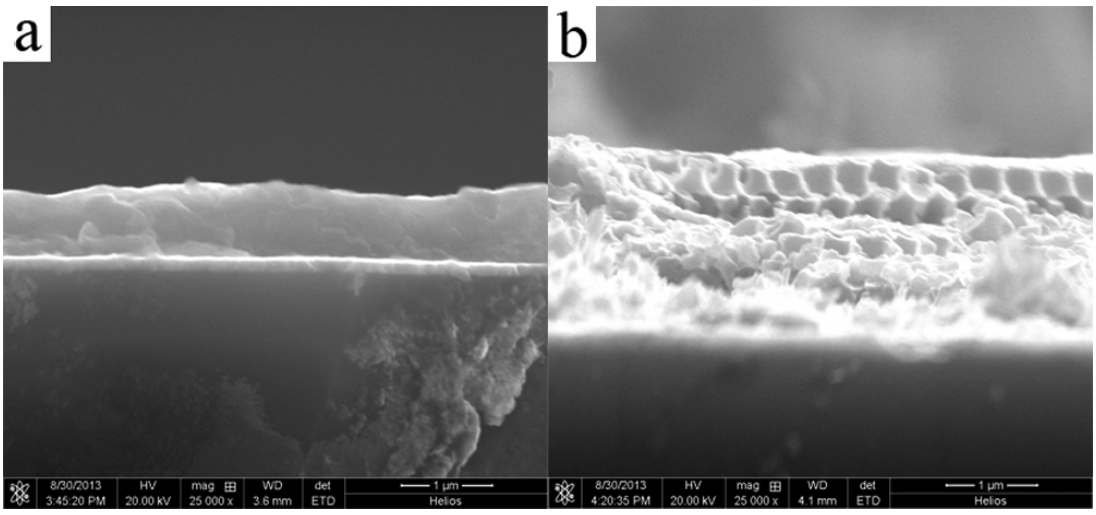

Fig. S2 The cross-sectional SEM of the dense Ge film(a) and 3DOM Ge film (b).

In order to show the thickness of the films, the cross-sectional SEM images of the Ge and 3DOM Ge films are added in Fig. S2. The thickness is about 1μm for dense Ge film and 2μm for 3DOM Ge, respectively. The mass of the electrodes is about 0.7mg. The electrodes are disks with diameter of 14mm, and the mass load is about 0.455 mg/cm^2.

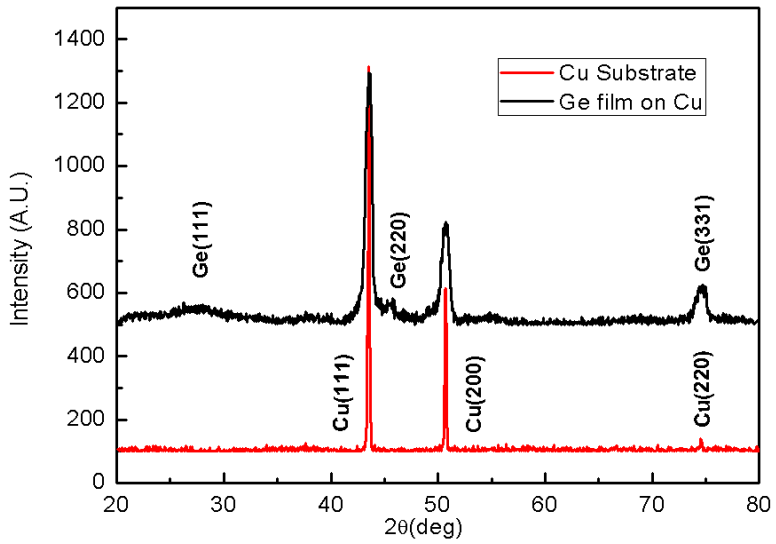

Fig. S3 Grazing incident XRD of Ge film on Cu substrate by ionic liquid electrodeposition

XRD analysis of the films was done by grazing incidence XRD (GIXRD) model using monochromatic Cu Ka radiation with a D8 Bruker diffractometer. X-ray scan is with an increment of 0.01° with time per step and the incident angle is 0.5°. Fig. S3 shows the XRD pattern of Ge film on Cu substrate. The diffraction peaks are corresponding to (111), (220) and (331) planes of the diamond structure of Ge (JCPDS number 04-0545). A broad 2θ peak at ~20-30° is attributed to the amorphous germanium. Ge(220) shows characteristic of nanocrsytalline germanium. And Ge (331) plane is overlapping with Cu (220), and shows a broad peak.

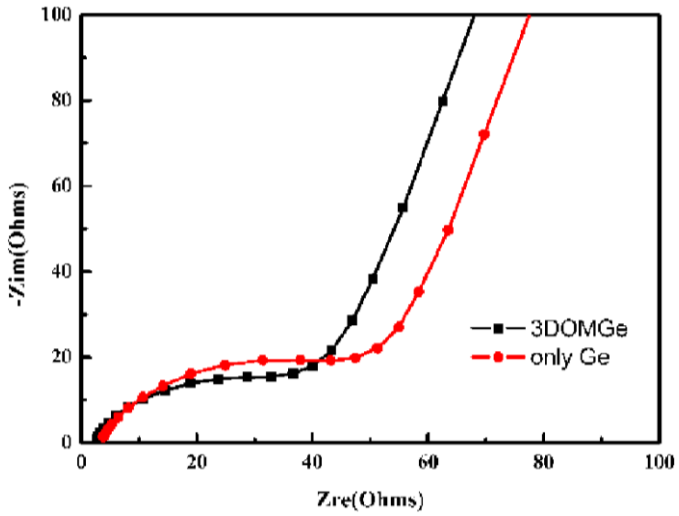

Fig. S4 Nyquist plots of the only Ge electrode and 3DOM Ge electrode (all of them are coated with carbon to enhance the conductivity).

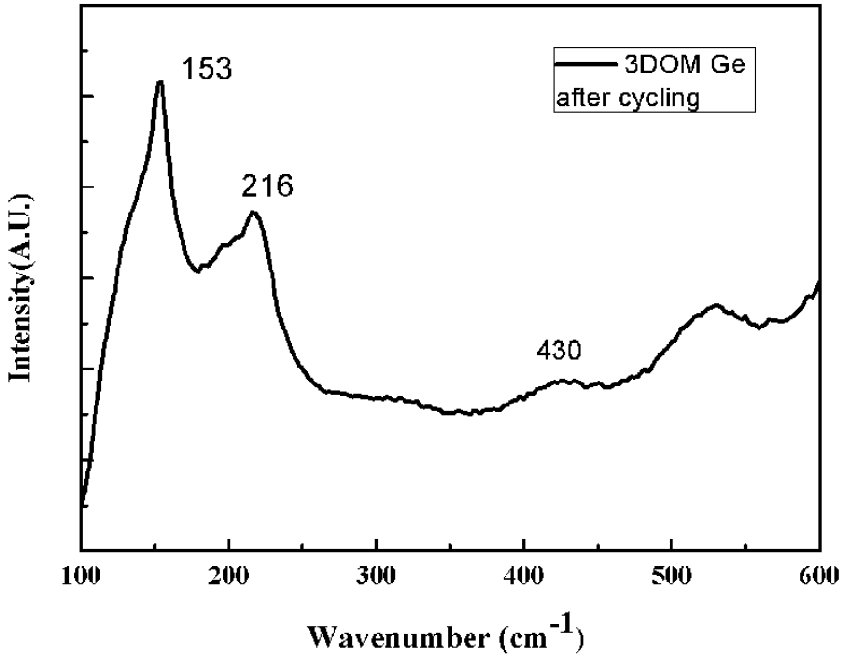

Fig. S5 Raman spectra of 3DOM Ge after 50 cycling.

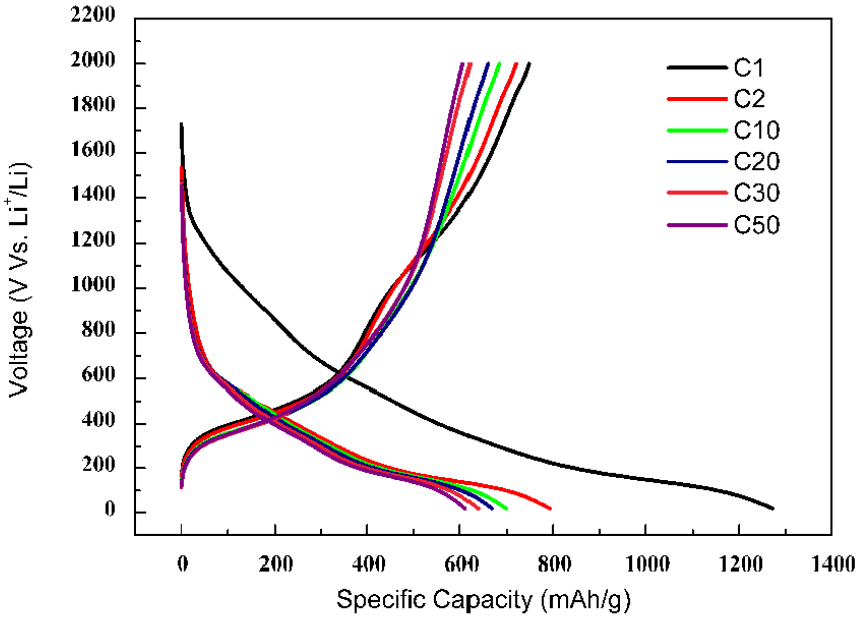

Fig. S6 Discharge-charge curves of only Ge electrode between 0 and 2V under a current density of 0.2C.

Table S1 Comparison of cycling performance with previous reports on Ge-based electrodes.

Ref.	Year	Structure	Fabrication method	Cycling performance		
				rate	cycle	reversible capacity(mAh/g)
	2013	3DOM	Ionic liquid electrodepsition	0.2	50	844
1	2012	Ge@C/RGO	Capped with oleylamine	0.031C	50	940
		Ge@C				490
2	2008	n-C/Ge	Solid-state pyrolysis	0.093C	50	From 1190 to 923
3	2013	Ge-NP slurry cast	40:20:40 =Ge NP : binder :Super-P	1C in EC:DMC	10 -200	from 1083 to 552
4	2011	Ge NW	Solid-liquid solution method	0.5C	100	963 to 400
5	2008	Ge NW	VLS growth	0.05C	20	1141
6	2013	Ge NW/ Graphite NF	LPCVD (Ge/G-30)	0.1C	30	remain 800
7	2013	Ge NW	Sn Catalyzed Ge NWs	0.4C	50	Sn/Ge 1000
8	2013	Graphene / GeNW	Ge NW VLS Graphene CVD	4C	200	1059
9	2011	Ge Nanotube	Kirkendall effect	40C	400	>1000
10	2012	As-deposited Ge	200-240nm thick	0.14C	25	325
		Ge nano structured film	Ion beam modified	0.14C	25	From 1352 to 1260
11	2004	Nanocrystline filme	PVD 236 μg	0.25C	50	1400 to 840
		Amorphous film	PVD(60-250nm) 0.042 μg		60	1700
12	2010	Ge film -40%SWCN	Electron beam evaporation	0.046C	10	825 to 700
13	2007	NP-Ge in Carbon matrix	Na naphthalide reduction	0.2C	30	729
14	2010	Mesoporous Ge	GeO+Mg etching	0.93C	20	950 to 789
15	2013	Ge-based 3D electrode	rf-sputtering	1C	50	1272
16	2013	Ge-CNT-Cu foam	GeO_2 reduction	0.93C	100	800
17	2013	Ge/graphene	thermal evaporation	0.625C	5	about 880
18	2012	3DOM Ge dense wall	CVD	0.2C	100	1027
		3DOM Ge porous wall				1155

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