Wet-chemical Route to Macroporous Inverse Opal Ge Anodes for Lithium Ion Batteries with High Capacity Retention

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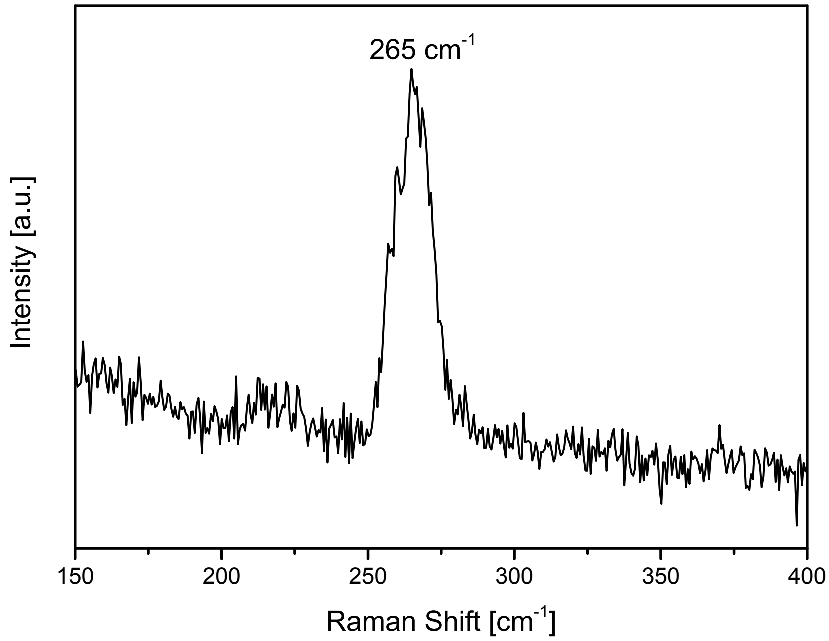

Figure S1: Raman spectrum of an amorphous Ge thin film on a Cu substrate.

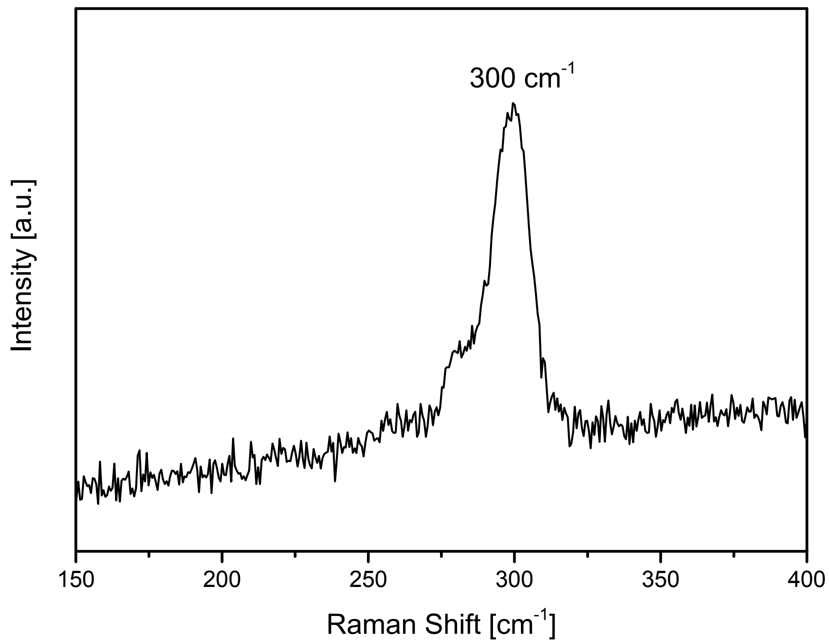

Figure S2: Raman spectrum of an α-Ge thin film on a Cu substrate.

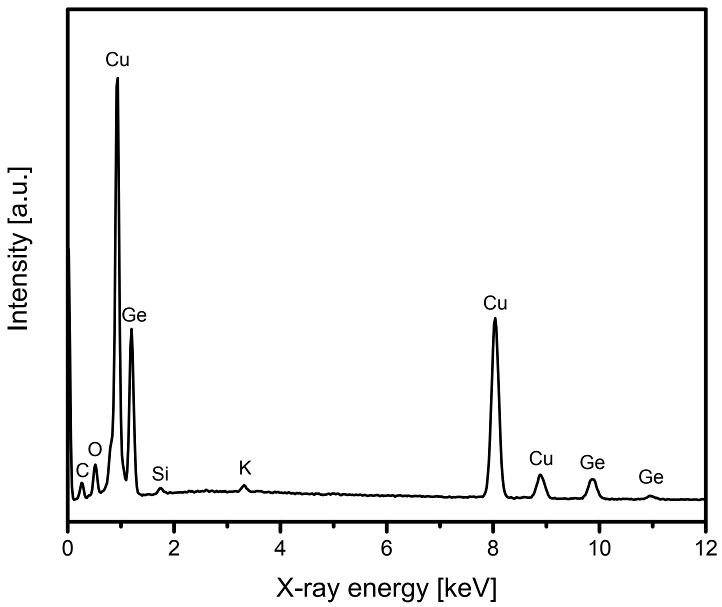

Figure S3: EDS spectrum of an amorphous Ge thin film on a Cu substrate.

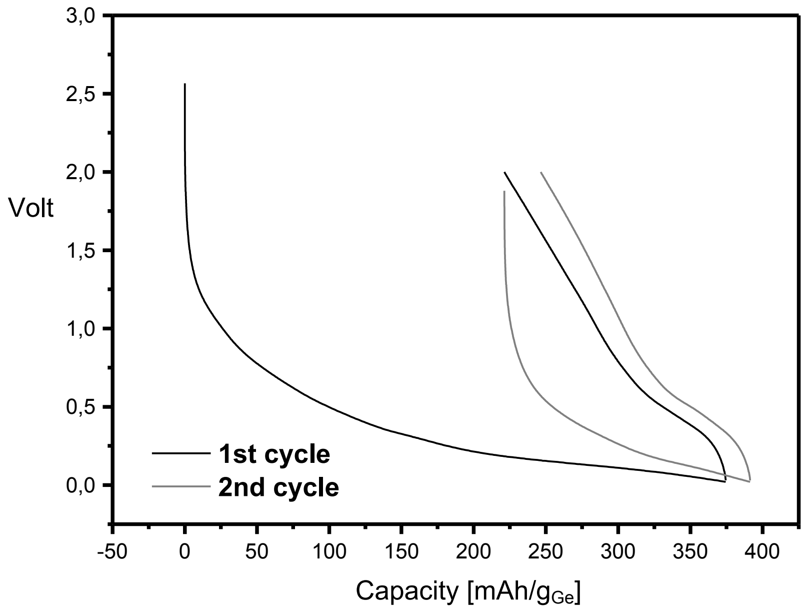

Figure S4: Voltage profile of the first and second cycle of an electrode made of an inverse opal-structured α-Ge thin film on a Cu substrate.

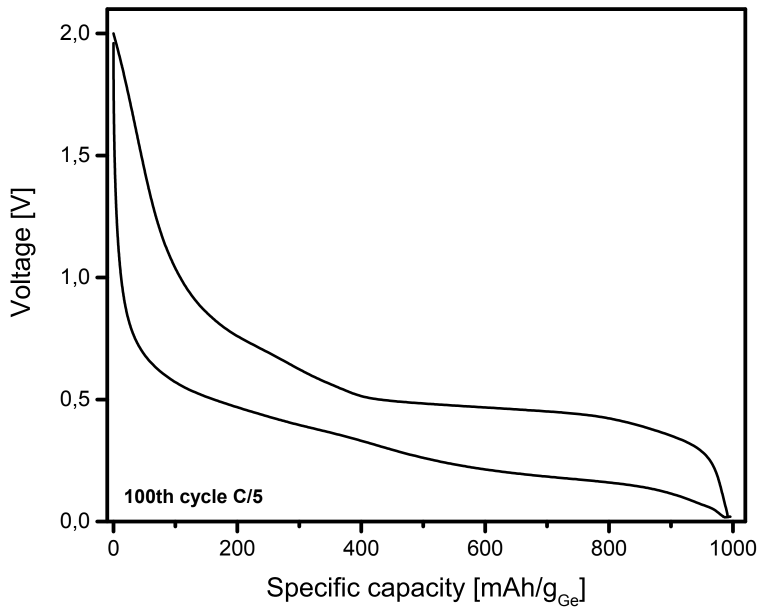

Figure S5: Voltage profile of the 100th cycle of an as-prepared inverse opal-structured amorphous Ge electrode.

Determination of the mass loading

The electrodes were prepared by infiltration of the PMMA spheres with 7 µL of a 0.1 mol/L K_4Ge_9/*en* solution which leads to a maximum loading of 282 µg of active material. Treatment with $GeCl_4$ vapor adds another 31 µg of Ge by cross-linking of the $[Ge_9]^{4-}$-clusters, and thus in total a maximum loading of 313 µg is achieved. The applied drop-casting process goes hand in hand with inevitable losses. Therefore we estimated the real mass loading of our electrodes by two different methods: using the before-mentioned concentration of the solution and the film thickness, we calculated the loading as follows:

$$V = \pi \times r^2 \times h \times (1 - 0.74) \tag{1}$$

where V is the volume, r the radius, h the height, and where the term between parentheses describes the spherical packing of the inverse opal structure, assuming a fcc packing of the PMMA opals.

This calculation under the assumption of an averaged film thickness of 2.75 µm gives a loading of 300 µg which is in good agreement with the maximum loading. For the determination of *C*-rates and capacities we went with a maximum loading of 313 µg to avoid an overestimation of our capacities.