Contribution ID: **40** Type: **Poster**

The influence of toluene in a Si/Ge sol-gel approach

Tuesday, 7 December 2021 10:30 (1h 30m)

Latest research has revealed promising results for silicon (Si) and germanium (Ge) as anode materials for lithium-ion batteries (LIBs). Owing to their high energy capacity these two group 14 semiconductors are considered as auspicious alternatives to graphite anodes in LIBs. In this study, we set the goal of synthesizing a porous silicon-germanium structure over a well-known wet chemical sol-gel approach. Here, the amphiphilic diblock copolymer polystyrene-block-polyethylene oxide (PS-b-PEO) is used as the structuring agent. As the silicon/germanium source, novel soluble 29 atomic Zintl clusters (K12SixGe17-x) are used. In the experiment, we investigate the structural difference that occurs when toluene is used as an additive. Real-space data as SEM and microscopy images will be discussed with reciprocal-space analysis methods as grazing-incidence x-ray scattering in small-angle mode and powder x-ray diffraction data. The study is completed by energy-dispersive X-ray spectroscopy (EDS). As EDS mapping can only probe the surface, we are highly interested in the Si/Ge distribution in bulk. Neutron Scattering in grazing-incidence mode (GISANS) is a key factor in analyzing the inner composition of the thin film.

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Session Classification: Poster Session

Track Classification: Soft Matter