One-dimensional germanium anode with tunable morphology for high energy and power density lithium-ion batteries

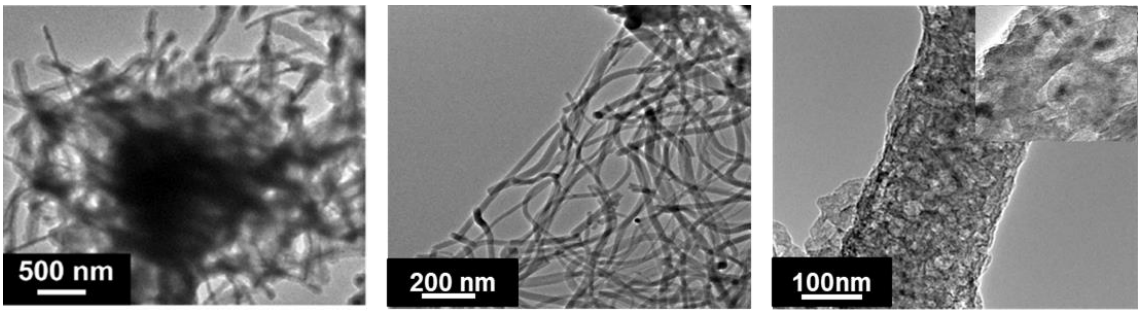
Gyujin Song[a], and Soojin Park[*a]
[a] *Department of Energy Engineering, School of Energy and Chemical Engineering, Ulsan National Institute of Science and Technology (UNIST), Ulsan 44919,Korea*

E-mail: ssong92@unist.ac.kr

With tremendous energy consumption and an advent of devices demanding high energy, lithium-ion batteries (LIBs) elicit the possibility as high energy applications recently [1]. In particular, germanium (Ge) anodes have been marked to materialize requirement due to numerous advantages including high capacity and low band gap with intrinsic reasonable electronic conductivity and ion diffusivity. However, its dramatic volume change has still restrained direct arrival as anode materials.

Many strategies have been attempted up to now such as modification of Ge morphologies, the synthesis of composite materials with one dimensional structure *via* a facile electrospinning method or VLS growth, thermochemical reduction, and solid-gas phase reduction reaction.

Modified one dimensional Ge materials, which involve vacant space or foreign atoms like zinc or carbon showing high porosity or well-distribution of atoms in Figure 1, increase electrolyte penetration, boost lithium ion diffusion rate in the electrode, further alleviate critical volume expansion due to the role of void spaces or pliable protecting layer, which guarantee prolonged and stable cyclability with high energy and power density [2]. Wherein, these simple structural alteration could exceptionally accommodate chronic drawback and robust electrochemical properties for feasible high energy and power density of LIBs.



References:
[1] J. Choi, D.Aurbach, Nat. Rev. Mat. 1 (2016), 16013
[2] S. Choi, Jieun Kim, D.Y. Hwang, H. Park, J. Ryu, S. Kwak, S. Park, Nano Lett., 16 (2016), 1179-1185