11th International Conference "Nanotechnologies and Nanomaterials"
NANO-2023, Bukovel, 16 - 19 August 2023

Silica -Based Lithium-Ion Battery Anode Nanomaterial

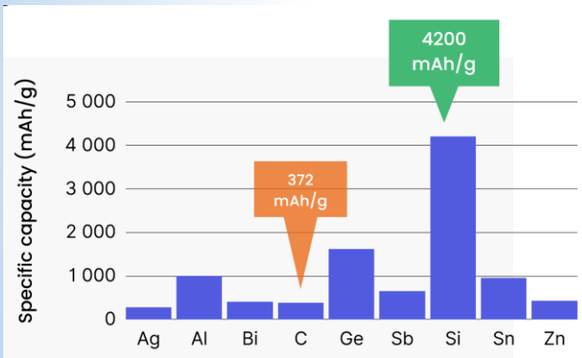
Kurbanov M.Sh.[1], Akhunov Kh. Kh.[1], Andriyko L.S.[2], Ashurov I.Kh.[1], Avvalboev A.A.[1], Zokhidov Kh.Kh.[1]

[1]Institute of Ion-Plasma and Laser Technologies named after U.A. Arifov, Durmon Yuli str., 33, 100125, Tashkent, Uzbekistan
[2] Chuiko Institute of Surface Chemistry, 17 General Naumov Str., 03164 Kyiv,
E-mail: andriykolyuda@gmail.com

In this work we briefly discus the trends, current problems and prospects for the use of silicon Si and its oxides SiO, SiO_2, which have a high theoretical capacity (4200, 2600 and 1965 mA·h/g, respectively). This means they can store more energy per unit mass compared to traditional graphite. However, anode materials based on Si and its oxides are associated with a large volume of expansion during charging and discharging of the battery, which can lead to damage to the anode structure, as well as low electrical conductivity. SiO_2 is considered as a potential replacement for the Si anode in LIB as it has moderate volume expansion (100 %) and low cost.

Experimental procedure, research method and materials

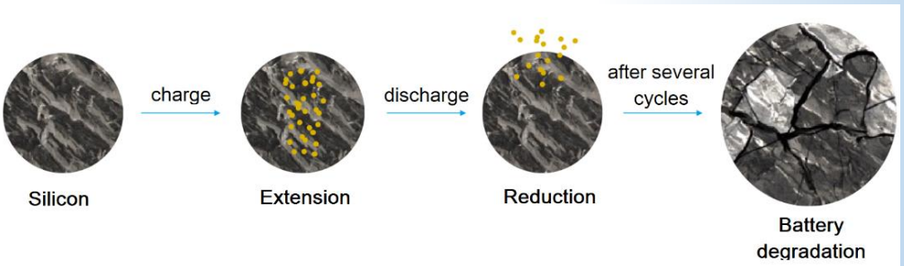
Graphite anode has a stable structure, good electrical conductivity, but a low capacity (372 mA·h/g), limiting LIB performance



Variants of anode materials

Anodes based on Si and its oxides suffer from large volume expansion during charging, impacting structural integrity and electrical conductivity

SiO_2 is a potential replacement for Si anode with moderate volume expansion (100%) and low cost



Disadvantages of silicon containing anodes

I Amorphous SiO_2 + Graphite → **II** Ball Milling → **III** Furnace → SiO_2/Graphite composite material

Results and discussion

Name	C (wt. %)	Potential U_{12} (mV)	Resistivity (mΩ/m)
Sample 1	30.0	1.599	55.90
Sample 2	50.0	0.281	9.84
Sample 3	70.0	0.076	2.66
Graphite	100.0	0.002	0.07

Conclusion: It is shown that the optimization of the SiO_2/C composite microstructure and the conditions of silica carbonization significantly affect the properties of the anode active material and, consequently, the electrochemical parameters of the LIB. It was found the higher the annealing temperature during the formation of the composite, the lower the capacity of the anode made from this material.