A facile synthesis of carbon coated amorphous SiO2 from rice husk as anode material for Li-ion batteries

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Aim of the work: creation of a lithium-ion battery with increased specific characteristics

Tasks to be solved as part of the work:

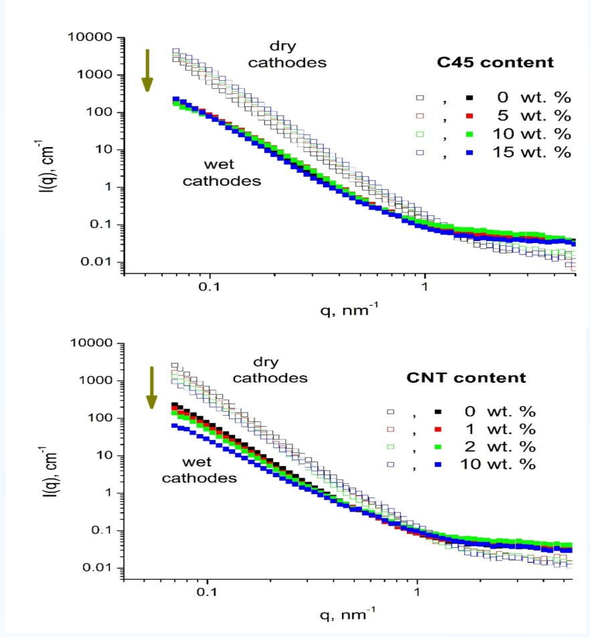
1) Comparative analysis of the microstructure of the cathode with different conductive additives based on the data of scanning electron microscopy and small-angle neutron scattering.

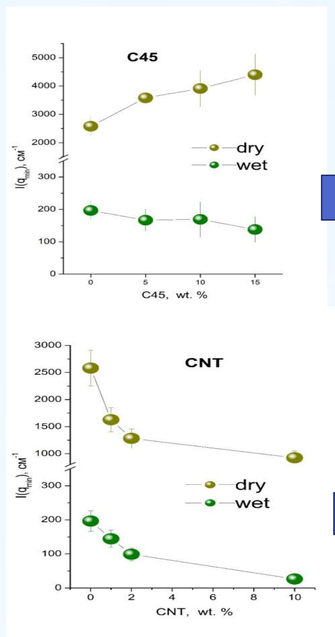
2) Investigation of the distribution of lithium by neutron radiography / tomography

3) Synthesis of carbon-coated SiO2 from rice husk as the anode material of lithium-ion batteries

4) Investigation of electrochemical characteristics of positive/negative electrodes with different composition and different microstructure. Determination of cycling resistance at different charge/discharge powers

SANS on cathodes with different mass content of C45 and CNTs





Incorporation of the C45 phase into the LFP matrix; slight increase in wettability.

Mixing of CNTs with LFP matrix; significant improvement in wettability.

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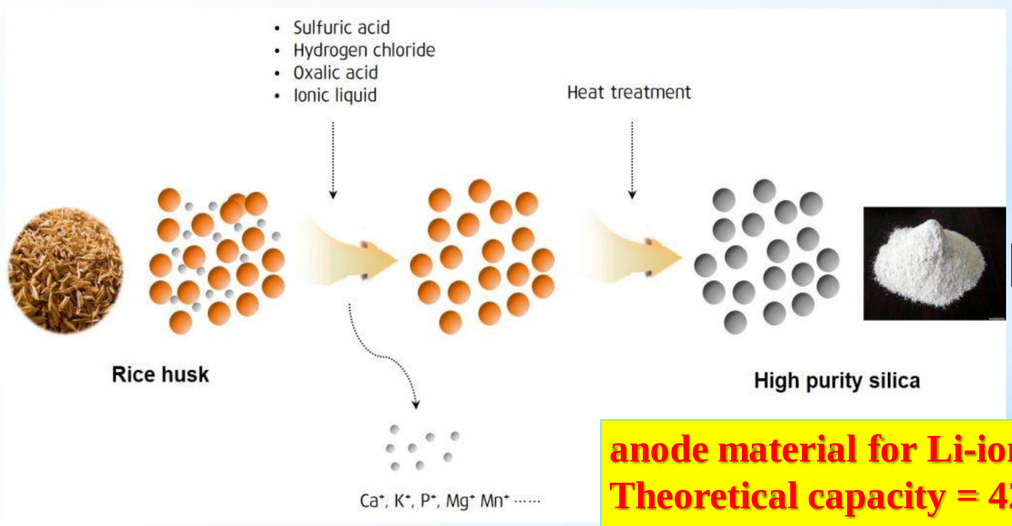
Electrode preparation

- Polymer binder Solef5130 dissolving in NMP
- Conductive additive C45, CNT
- Active material LiFePO4
- Electrodes were prepared by dr.blade casting onto 20μm Al-foil
- Electrochemical tests were carried out in 2032-type coin cells

- **Mixing on High-shear overhead mixer for 24 hours**

Synthesis and production of anode material from biowaste



anode material for Li-ion battery
Theoretical capacity = 4200 mAh/g
10 times bigger than graphite

Prototype fabrication

Figure 4. Electrode stack

Figure 5. pouch cell case parts

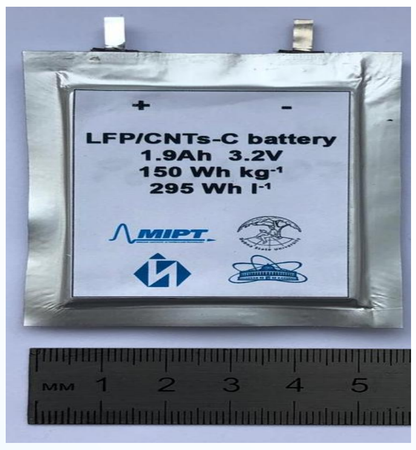
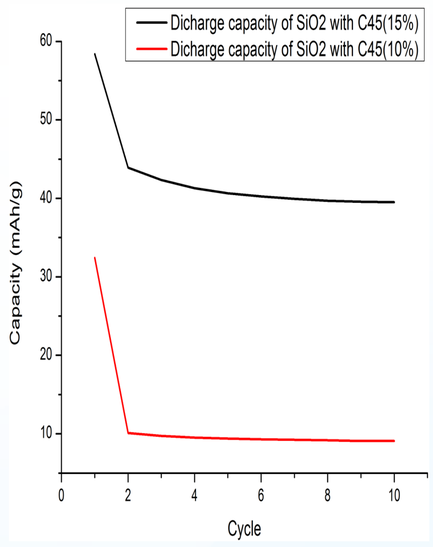
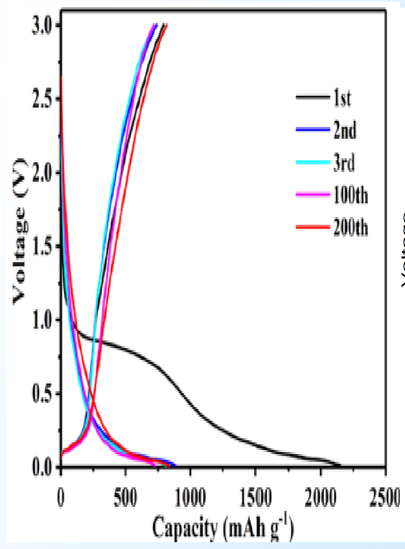
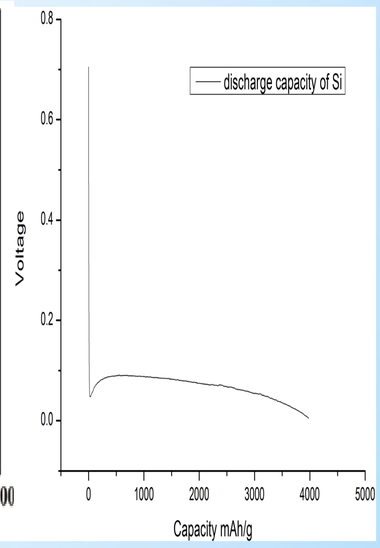


Figure 6. pouch cell after the formation and re-sealing

Main results







The practical applicability of the considered electrode technology was approved on the pouch cell prototype with specific energy density of 150 Wh kg^{-1}/295 Wh l^{-1}.

References

1) M.V.Avdeev, **M.S.Yerdauletov**, O.I. Ivankov, and V.A. Krivchenko et al. On the effect of Carbon additives on the Porosity of Positive Electrodes Based on LiFePo4 for Lithium - ion Batteries. *Journal of Surface Investigation: X-ray, Synchrotron and Neutron Techniques, 2019, Vol. 13, No. 4, pp. 614–618.*
2) P.Napolskiy, M.V.Avdeev, **M.S.Yerdauletov**, O.I. Ivankov, and V.A. Krivchenko et al. On the use of carbon nanotubes in prototyping the high energy density Li-ion batteries// *Energy Technology, 2020, 8 , 2000146*

Conclusion

1) The influence of CNT additives on the rheological properties of the electrode suspension and the structure of the electrode surface was determined.

2) Anode materials were obtained from biowaste

3) Prototypes of lithium-ion batteries were manufactured