TIN OXIDE – CARBON NANOCOMPOSITES AS ANODE MATERIALS FOR LITHIUM ION BATTERY APPLICATIONS

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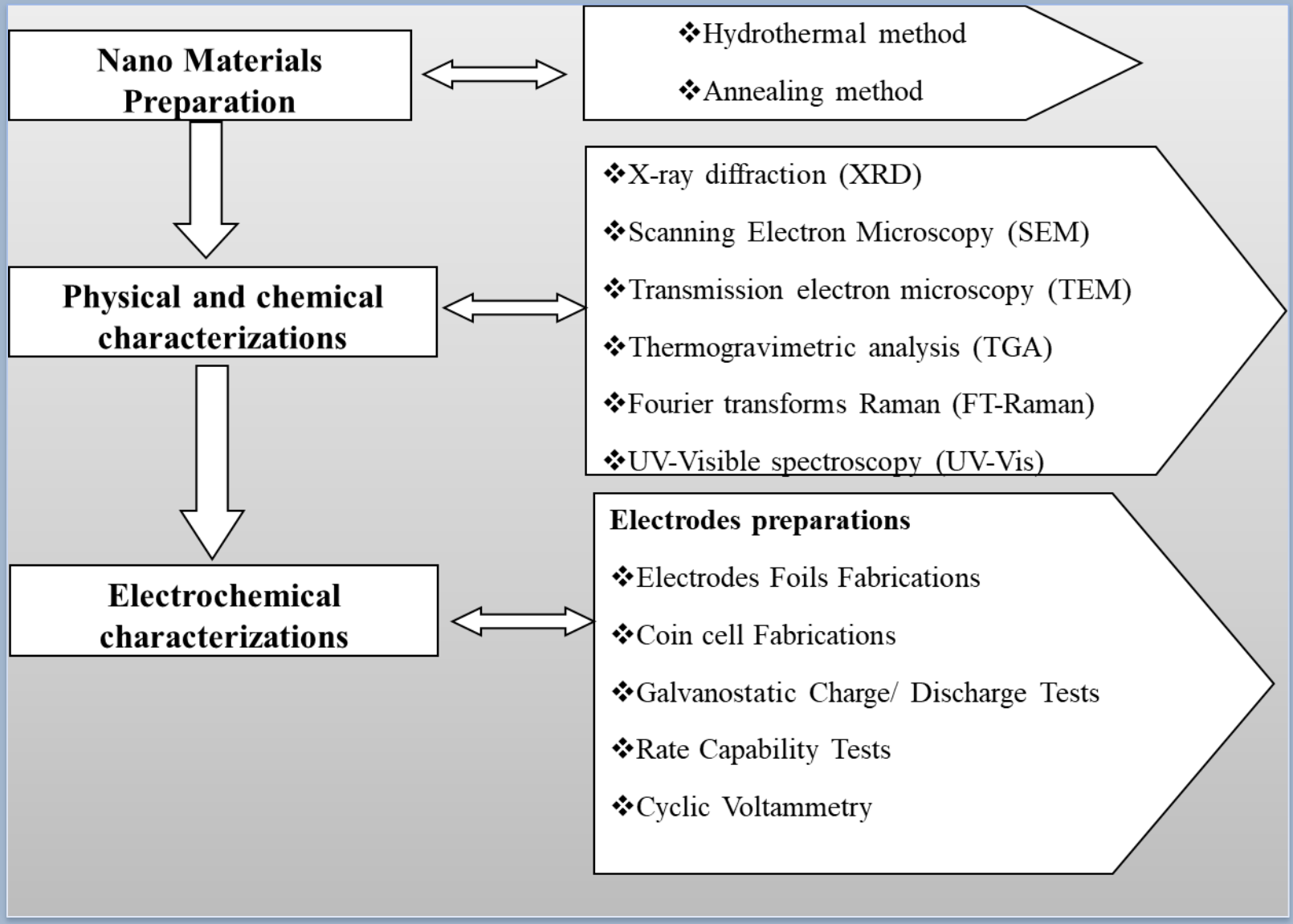
Introduction

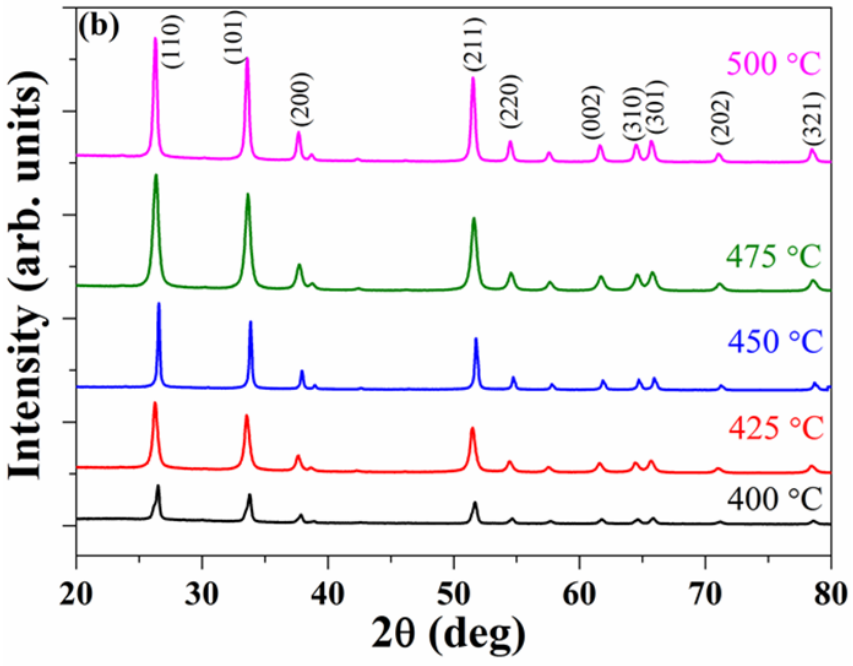
Compared to the conventional batteries, such as lead-acid batteries and nickel metal hydride, Lithium ion batteries have higher energy density, Furthermore, lithium ion batteries have high power density, low self-discharge rate, and no memory effect, which has promoted their extensive development during the last two decades

The rapidly developing of various electronic devices such as electrical vehicles and hybrid electric vehicles, the demand for high energy storage system has significantly increased.

Lithium ion batteries are the main electrochemical energy storage devices whose energy density and performance largely depend on the chemical and physical properties of the electrode materials. In this research study, several carbon-based nanomaterial are synthesized and employed as the potential electrode materials in the lithium-ion batteries towards performance improvements.

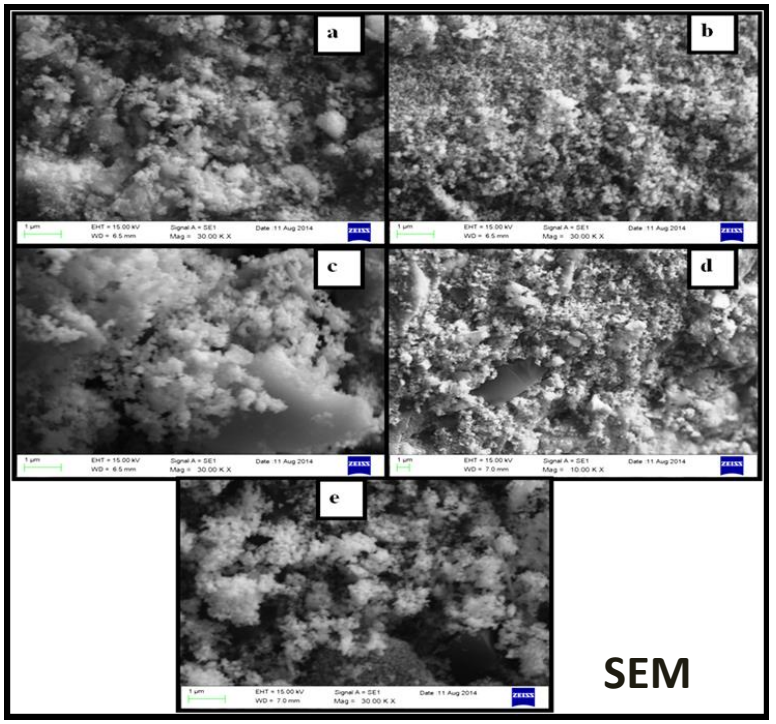
Preparation and Characterizations Technique



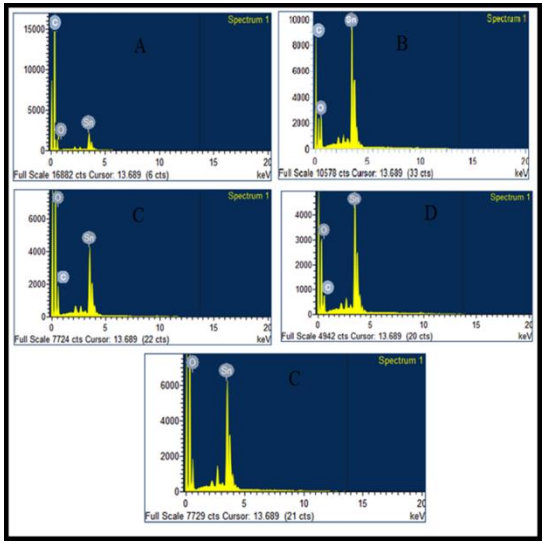


XRD

S.No	Calcination Temperatures (°C)	Crystallite Size (nm)
1	400	16.6
2	425	18.9
3	450	24.9
4	475	28.5
5	500	35.6

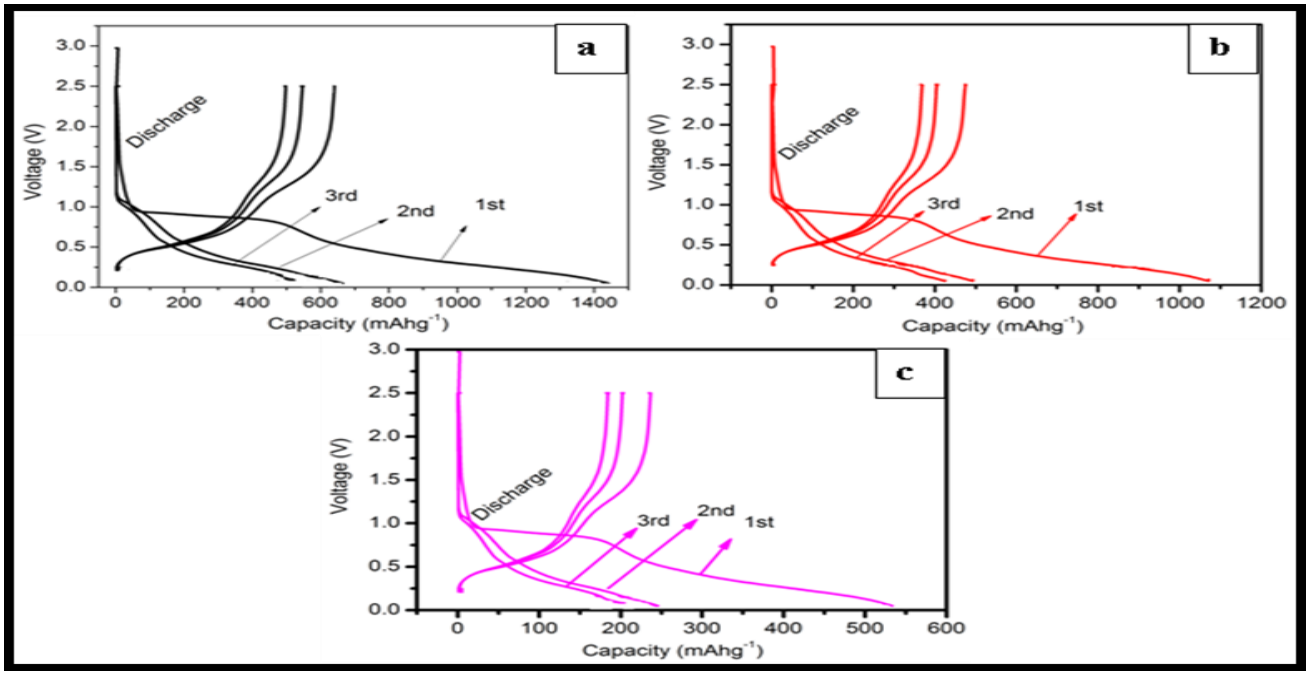


SEM

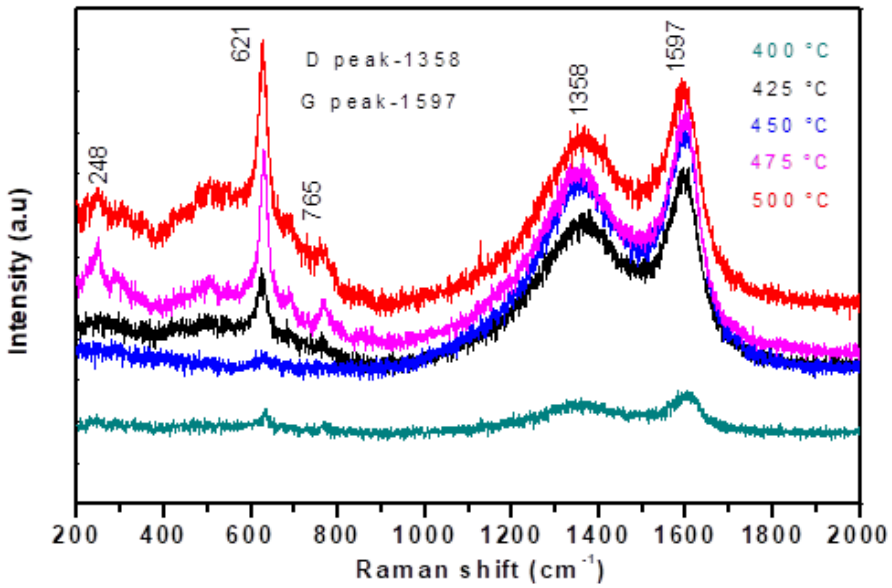


EDAX

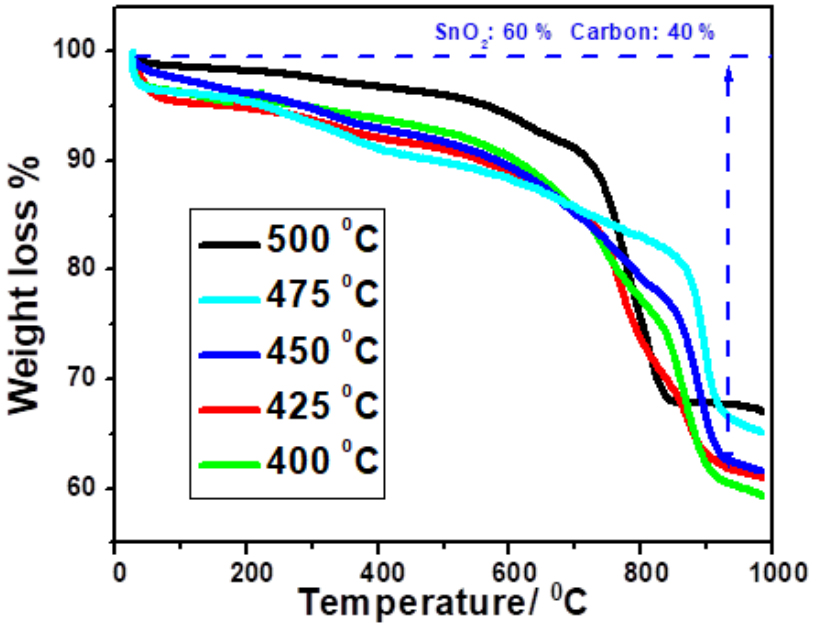
Galvanostatic Charge-Discharge profiles

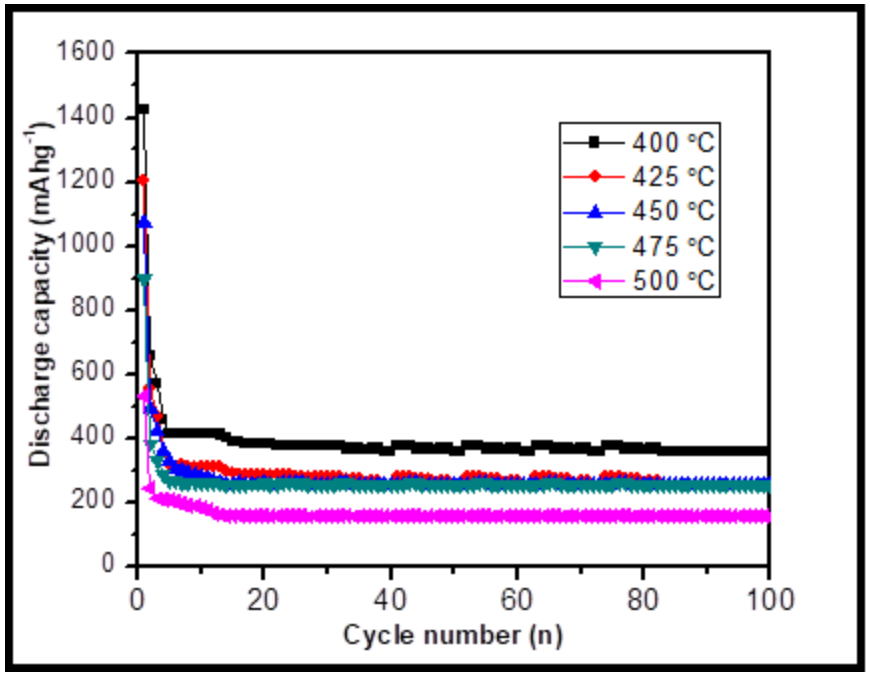


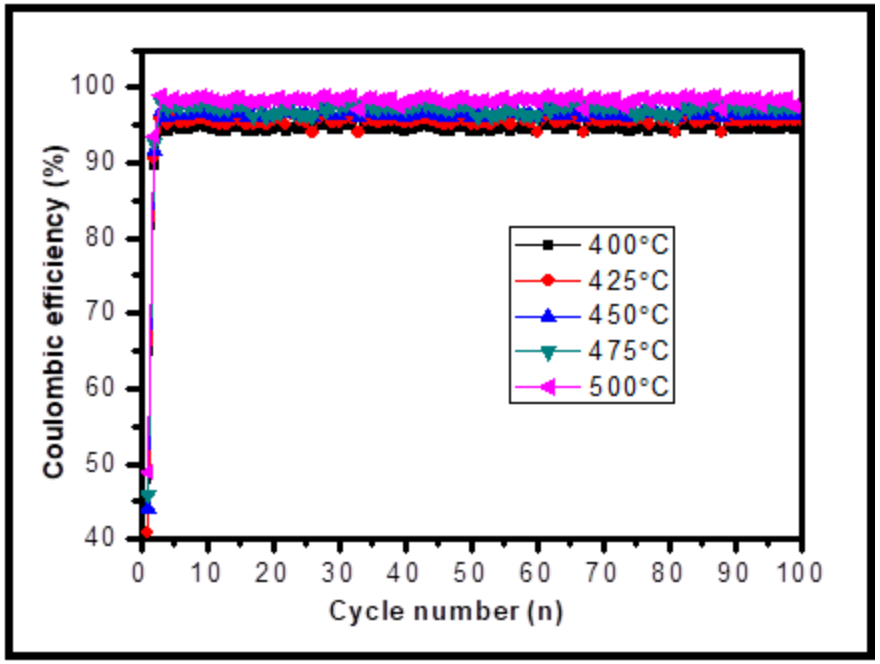
FT-Raman



TGA Analysis







Cycling performance and columbic efficiency

The columbic efficiency versus cycle numbers at a current density of 100 mA/ g for the heat treated nanocomposites. The initial columbic efficiency was found to be 38.7 (400 °C), 41.5 (425 °C), 43.3 (450 °C), 45.8 (475 °C) and 48.7 (500 °C), respectively. The low value of coulombic efficiency was due to Li2O solid electrolyte interface formation (SEI) during the first charge-discharge process. After five cycles, the columbic efficiency increases rapidly, and attains more than 95 % for all samples

Conclusion

The electrochemical cycling performance behaviour of the Nano composite has been tested by galvanostatic charge-discharge cycling study. The carbon content was effectively modified by optimizing the reaction temperature and its electrochemical performance was analyzed.

The results confirmed that when carbon content in the nano composite is sintered at 400 °C, a promising Li storage capacity is achieved at 581 mA h /g with good stability until 40 cycles with current density of 100 mA /g. It was also showed higher columbic efficiency of 95%. Here, we have developed an easy, cost effective and non-hazardous technique to synthesize a potential anode material for Li-ion battery.

The method proposed the economically cheaper and efficient anode materials by incorporating carbon in the SnO_2 nanostructured to improve the electrochemical performance of the battery.

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