

SUMMARY OF THE MINOR RESEARCH PROJECT

Title of the Research Project :

**Investigations on Electrical, Magnetic,
Electrochemical behaviour of NASICON and Olivine
Materials**

(UGC approval Letter No. and Date: MRP(S)-0793/13-
14/KLMG019/UGC-SWRO dated 28.03.2014)

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PI has explored hydrothermal method to synthesise various OLINIVE Olivine structured using different templates in various ratios.

Olivine structured Lithium manganese phosphate LiMnPO_4 is synthesized in the different sucrose to metal molar ratios *ie.* 2:1, 4:1, 6:1, 8:1, 10:1 by hydrothermal method. The formation of LiMnPO_4 is confirmed by XRD analysis. All ratios are crystallised in single phase. The d-spacing, lattice parameters, FWHM, grain size are calculated from XRD pattern. It has been observed that the grain size increases with increasing template ratio. While, unit cell parameters are independent of template ratio. It is a very simple and scalable pathway towards synthesis of metal nitrate hollow spheres. After the hydrothermal treatment of mixtures of carbohydrates with metal salts in water in sealed steel autoclaves at 120 °C, carbon spheres with the metal precursors tightly embedded in the microspheres were obtained. The removal of carbon directly results in hollow spheres of the corresponding metal nitrates that are composed of nanoparticles with high surface areas.

Glucose is used as template in five different molar ratios with metal ions to synthesise LiMnPO_4 . The synthesized samples are formed as microcrystallites of LiMnPO_4 with few impurity peaks. Using UNITCELL software, lattice parameters and cell volume are calculated. Local structure confirmed the formation of LiMnPO_4 structure by exploring FTIR studies. Irregularity in the crystallite size and cell parameters might be an indication of failure in the selection of template material. Irregularity in the crystallite size and cell parameters might be an indication of failure in the selection of template material. The morphological analysis can be done using electron microscopic analysis. It is a very simple and scalable pathway towards synthesis of metal nitrate hollow spheres. After the hydrothermal treatment of mixtures of carbohydrates with metal salts in water in sealed steel autoclaves at 120 °C, carbon spheres with the metal precursors tightly embedded in the microspheres were obtained. The removal of carbon directly results in hollow spheres of the corresponding metal nitrates that are composed of nanoparticles with high surface areas.

Olivine structured LiNiPO_4 is synthesized using hydrothermal method for 2:1, 4:1, 6:1, 8:1, 10:1 template-metal ratios. The formation of LiNiPO_4 is confirmed by X Ray Diffraction analysis. From the XRD pattern, the values of d-spacing, lattice parameters, FWHM and grain size are calculated. It has been observed that the grain size increases with increasing template ratios. The deviation for 2:1 and 4:1 ratios are due to the variation in sintering process. It has also been observed that the unit cell parameters are independent of template ratios.

PI has produced interesting combination of the OLIVINE for the applications in Li ion batteries. These materials needs to be investigated further to understand the increase in ion conductivity and ion dynamics both microcrystalline and nanocrystalline form.