# Development of supercritical hydrothermal synthesis of lithium iron phosphate ($LiFePO_4$); For a better mixing tee of continuous system

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A supercritical hydrothermal synthesis (SHS) in a continuous system has been developed for nanosize particle or metal oxides. The solutions are effected the nucleation and growth rate as mixing conditions during SHS process. This study presents the developed the electrochemical performances of lithium iron phosphate ($LiFePO_4$) using various mixing tees for improved mixing of the fluids. The LiFePO4 particles were characterized in detail using X-ray diffraction (XRD), scanning electron microscopy (SEM), Brunauer, Emmet, and Teller (BET) analysis, thermal gravimetric analysis (TGA), and charge-discharge testing. And they were examined by using CFD simulation. The particles have a smaller size (6-17 $m^2/g$ for BET surface area) and have been controlled their size and morphology. The crystallinity is responsible for the highly performance of the LiFePO4 particles hydrothermally synthesized under supercritical water condition. And the as-SHS LiFePO4 delivers reversible capacity of about 90 mAh/g at a current density of 0.1 C without carbon coating. Almost no capacity decay at ~ 152 mAh/g is observed during the 30 cycles in carbon-coated $LiFePO_4$ synthesized using SHS method.