

# Thermodynamic analysis of $\text{LiFePO}_4$ precursor prepared by co-precipitation method

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**Abstract:** Based on thermodynamics, principles of mass and charge conversion in solution, thermodynamic analysis was carried out in co-precipitation process of  $\text{FePO}_4$ , a precursor of  $\text{LiFePO}_4$  cathode. The relationships between total iron ion concentration ( $C_{\text{Fe}}$ ), different soluble iron compounds concentrations with pH value in solution, concentrations of  $\text{H}_3\text{PO}_4$  ( $C_{\text{P}}$ ) and  $\text{NH}_3$  ( $C_{\text{N}}$ ) were deduced. With the increasing of pH value in solution,  $C_{\text{Fe}}$  increased firstly and then decreased with lowest concentration at  $\text{pH}=5.0$ . pH in solution had different effects on the concentrations of soluble iron compounds: with the increasing of pH, the concentrations of  $\text{Fe}^{3+}$ ,  $\text{Fe}(\text{OH})^{2+}$ ,  $\text{Fe}_2(\text{OH})_2^{4+}$ ,  $\text{Fe}_3(\text{OH})_4^{5+}$  decreased gradually; before  $\text{pH}=11.0$ , the concentration of  $\text{Fe}(\text{OH})_2^+$  remained constantly, however, the concentrations of  $\text{Fe}(\text{OH})_3$ 、 $\text{Fe}(\text{OH})_4^-$  increased with the increasing of pH value.  $C_{\text{N}}$  had no effect on the concentrations of  $C_{\text{Fe}}$  and other soluble iron compounds. During the co-precipitation process of  $\text{FePO}_4$ , reasonable pH value in solution was 2.4~4.2.

**Key words:**  $\text{FePO}_4$ ; precursor; coprecipitation; thermodynamics