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Synthesis and Performance of $LiFe_{1-x}Mn_xPO_4$ in Lithium-ion Battery KHADIJE BAZZI, MARYAM NAZRI, Wayne State University, PREM VAISHNAVA, Kettering University, VAMAN NAIK, University of Michigan Dearborn, GHOLAM-ABBAS NAZRI, RATNA NAIK, Wayne State University — Olivine-type lithium transition metal phosphates (i.e. $LiFePO_4$) have been intensively investigated as promising electrode materials for rechargeable lithium-ion batteries. There have been attempts to improve energy density and voltage quality of phosphate based electrode. In this study, we have partially substituted Fe^{II}/Fe^{III} redox center with Mn^{II}/Mn^{III} in $LiFePO_4$ that provides over 600 mV higher voltage. We prepared various compositions of $LiFe_{1-x}Mn_xPO_4$ (x=0, 0.2, 0.4, 0.6, 0.8 and 1) between the two end members ($LiFePO_4$ - $LiMnPO_4$). Due to intrinsic low electronic conductivity of lithium transition metal phosphates, we coat these materials with a uniform conductive carbon through a unique sol-gel process developed in our laboratory. In addition, we made a composite of the carbon coated phosphate with carbon nano-tubes to develop a highly conductive matrix electrode. We report the materials structure, morphology, electrical conductivity and electrochemical performances of $LiFe_{1-x}Mn_xPO_4$ using XRD, Raman spectroscopy, SEM, TEM, XPS, electrical conductivity and galvanostatic charge/discharge measurements.

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