

ABSTRACT

Sol-Gel auto combustion technique was used to synthesis Pr³⁺ substituted LiCoO₂ lithium-rich cathode materials to improve the cycling performance. Samples with different concentration of Pr containing LiCo_{1-x}Pr_xO₂ ($0 \leq x \leq 0.10$) were chemically prepared and calcined the obtained powders at 750 °C for 6 h. Various techniques for the investigation of Praseodymium behaviour in LiCoO₂ have been utilized, such as x-ray diffraction (XRD), Field emission scanning electron microscope (FESEM), Attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR), Energy dispersive spectroscopy (EDX) and Cyclic voltammetry (CV). The formation of a hexagonal lattice of the α -NaFeO₂ structure of LiCoO₂, having space group R-3m is confirmed by x-ray diffraction analysis and the crystalline size of all samples are in a range of 12-20 nm. FESEM results reveal that by increasing Pr contents the grain growth becomes distinct and well defined and this result also reveals that particle size for all samples are in a range of 8.5-14.34 micrometres. In addition, functional bonding has been confirmed by using ATR-FTIR spectroscopy, which depicts the existence of characteristics Co–O stretching bond in the range 560–590 cm⁻¹. EDX spectroscopy technique shows that all the samples are strongly matched with a standard peak position of Li, Co, Pr and O, without containing any foreign element .2032 type coin cells were cycled at a constant rate, an excellent cycling performance with capacity retention by a factor of ~2 in comparison to the pristine LiCoO₂ was observed for the composite. This reveals the structural stability induced by Pr doping. Remarkable improvement in reversibility and stability of the Pr doped electrodes has been analysed by cyclic voltammetry (CV). These composite cathodes might be very useful for high rate power applications.