A study on the Production of $Li_{1.0}(Ni_{0.83}Co_{0.12}Mn_{0.05})O_2$ Cathode materials Using a Novel Taylor-Couette Flow Reactor Process

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High Nickel NCM cathode such as $Li_{1.0}(Ni_{0.83}Co_{0.12}Mn_{0.05})O_2$ is now recognized as the most attractive material compared to the commercialized cathode material due to its high discharge capacity. Specially, high nickel NCM cathode such as $Li_{1.0}(Ni_{0.83}Co_{0.12}Mn_{0.05})O_2$ is now considered as a promising candidates for the applications in the long-rage electric vehicles(EV). Recently, many companies try to commercialize this kind of material. However, they could not commercialize until now due to its high production cost. This high production cost is due to its special sintering process as well as complicated precursor synthesis process. For example, batch process in high nickel fabrication has been widely used in the industrial field to produce the $Ni_{0.83}Co_{0.12}Mn_{0.05}(OH)_4$ precursor but its method required long reaction time to produce high nickel NCM precursor resulting in the low production efficiency. This is due to the fundamental limitations of the batch reactor such as the low mass transfer rate and required complete mixing zone to stabilize the system. This is not limited to the batch reactor but also to CSTR reactor. In this study, we introduced the taylor-couette flows to improve and increase the reaction rate inducing the increased mass transfer rate and production efficiency.

In this study, we synthsised $Li_{1.0}(Ni_{0.83}Co_{0.12}Mn_{0.05})O_2$ cathode material using taylor-couette reactor. The impact of parameters pH, operating rpm, and feed retention time were thoroughly investigated to assess the posibility of creating $Ni_{0.83}Co_{0.12}Mn_{0.05}(OH)_4$ precursor. Using optimized precursors, $Li_{1.0}(Ni_{0.83}Co_{0.12}Mn_{0.05})O_2$ cathode material was prepared and electrochemical performances at 25℃ and 45℃ were characterized. In addition, produced precursors are characterized by SEM, ICP, PSA.

References:

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