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Li-rich nanoplates of $\text{Li}_{1.2}\text{Ni}_{0.13}\text{Co}_{0.13}\text{Mn}_{0.54}\text{O}_2$ layered oxide with exposed {010} planes as a high-performance cathode for lithium-ion batteries

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Abstract: The layered lithium-rich cathode material $\text{Li}_{1.2}\text{Ni}_{0.13}\text{Co}_{0.13}\text{Mn}_{0.54}\text{O}_2$ crystallizes with an $\alpha\text{-NaFeO}_2$ structure, through which Li^+ ions are transported along two-dimensional channels. In this work, nanoplates of $\text{Li}_{1.2}\text{Ni}_{0.13}\text{Co}_{0.13}\text{Mn}_{0.54}\text{O}_2$ (NP-LNCMO) with exposed {010} planes are successfully synthesized. The formation of open structures provides unimpeded paths for Li^+ ion intercalation/deintercalation. The synthesis involves the use of ethylene glycol with two hydroxyl groups as the solvent, which can also react with the transition metal ions to yield plate-like structures with exposed {010} planes. NP-LNCMO displays a high specific discharge capacity of 288.9 mAh g^{-1} at 0.1 C (1 C = 300 mA g^{-1}) and an excellent rate capability (a discharge capacity of 109.7 mAh g^{-1} at 15 C). Furthermore, negligible voltage decay occurs during 50 charge/discharge cycles. The excellent electrochemical performance of NP-LNCMO can be attributed to the formation of nanoplates with exposed electrochemically active {010} planes.

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