Highly Elastic Binder for Improved Cyclability of Nickel-Rich Layered Cathode Materials in Lithium-Ion Batteries

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Nickel-rich layered cathode materials are predominantly used for lithium-ion batteries intended for electric vehicles owing to their high specific capacities and minimal use of high-cost cobalt. The intrinsic drawbacks of nickel-rich layered cathode materials with regard to cycle life and safety have largely been addressed by doping with foreign atoms and by applying surface coating. Here, we report that a highly elastic binder, namely spandex, can overcome the problems of nickel-rich layered cathode materials and improve their electrochemical properties drastically. The high elasticity of spandex allows it to uniformly coat $LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$ particles via shear force during slurry mixing to protect the particles from undesired interfacial reactions during cycling. The uniform coating of spandex, together with its hydrogen bonding interaction with $LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$, leads to enhanced particle-to-particle interaction, which has multiple advantages, such as high loading capability, superior rate and cycling performance, and low binder content.