Surface modification of Li-ion battery separator with vapor phase deposited polymer film : Improved thermal stability and electrolyte wettability

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Thermally stable Li-ion battery separator was fabricated by depositing a highly cross-linked polymer, polyhexavinyldisiloxane (pHVDS), on polyethylene (PE) separator (pHVDS-coated PE) via an initiated chemical vapor deposition (iCVD) process. Even after the pHVDS coating, the porous structure of the separator was well preserved owing to the conformal nature of the vapor phase deposition. The coating thickness was delicately controlled so the pore size decrease was below 7 % compared to the original dimension. The pHVDS-coated PE showed improved thermal stability and electrolyte wettability compared to the bare counterpart. Incubating the pHVDS-coated PE at 140 ℃ for 30 min caused only a 12 % areal shrinkage from its original size while the pristine separator underwent a far higher shrinkage of 90 % after the same treatment. The superior wettability resulted in an increased electrolyte uptake and ionic conductivity, leading to significantly improved rate performance of a Li-ion battery. The pHVDS coating and its chemical functionality were maintained throughout 70 deep charge-discharge cycles.