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Water-based ceramic coating separator for lithium metal secondary batteries by using plasma treatment

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Many commercial ceramic coated separators have been introduced to improve safety of large format lithium metal secondary battery even at various abnormal conditions. However, because of hydrophobic surface of commercial olefin separators, non-polar organic solvents had to be used. Typically, organic solvents are expensive and toxic. This is why water-based ceramic coating method should be developed. Here in, we introduce a plasma treatment technique, to make aqueous ceramic coating separator. An atmospheric radio frequency (RF) plasma generator was used for the surface modification of the bare PE separators. The plasma treatment changed the surface of the polyethylene (PE) separator from hydrophobic to hydrophilic. Water-based coating slurry was uniformly coated on PE separators without defects. Recently, we introduced aqueous ceramic coated technique using surfactant. Here, to investigate the effect of plasma treatment process, we used this surfactant ceramic coated separator as control cases. As a result, plasma-treated ceramic-coated separators (plasma CCSs) exhibit superior power capability and cycle performance (plasma CCS maintained 94.7% of the initial discharge capacity up to the 1000th cycle at C/2, whereas bare PE's remained high only up to the 300th cycle) in unit cells based on lithium metal anodes.

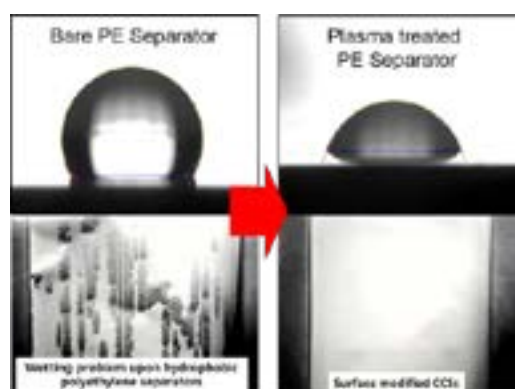


Figure 1: Effect of water-based Al_2O_3 ceramic coating using plasma treatment.

Biography

Hyunkyu Jeon has expertise in separators of lithium secondary batteries. He developed a low cost, facile, efficient, and environmentally friendly water-based method to prepare inorganic/polymer composite coating layers on separators after years of experience in research in Hanbat National university energy united laboratory.

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