Uniform thin film based polymer separators for rechargeable Li-ion batteries

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Battery separator's main function is to prevent physical contact of the electrodes while permitting ions to flow freely. They itself does not participate in any cell reactions, however, its properties significantly determine the performance and safety of the batteries. For high energy and power densities, the separator is required to be very thin and highly porous, while it adversely affects the safety and cycle life of the battery as a result of the reduced mechanical strength. The safety requirement is a top priority for rechargeable Li-ion batteries, especially these used in hybrid electric vehicles and power tools. Battery separators need to have excellent porosity, as well as low cost, lightness and durability.

Nearly all microporous polymer separators used in the current Li-ion batteries are based on semi-crystalline polyolefin materials, including polyethylene (PE) [1], polypropylene (PP) [2] and their blends such as PE–PP [3] and high density polyethylene [4]. The methods for manufacturing the microporous membranes can be divided into dry process and wet process. Separators made by the dry process generally show a distinct slit-pore and uniform microstructure, while those made by the wet process exhibit interconnected spherical or elliptical pores. The most expensive, quality determining component of extrusion is a die.

As the separator is the most critical component in all rechargeable Li-ion batteries we would like to discuss the possible routes of manufacturing the extrusion die for obtaining uniform thin film separators for rechargeable Li-ion batteries.

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