

Polymeric Mesoporous Separator Elements for Laminated Lithium-Ion
Rechargeable Batteries

ABSTRACT OF THE DISCLOSURE

A mesoporous polymeric membrane for use as an ionically-
conductive inter-electrode separator in a rechargeable battery
cell is prepared from a coatable composition comprising a
polymeric material, a volatile fluid solvent for the polymeric
material, and a second fluid miscible with and of lesser
volatility than the solvent, the second fluid being a
nonsolvent exhibiting no significant solvency for the polymeric
material. A layer is cast from the composition to form a layer
which is gelled and solidified to a self-supporting membrane by
volatilizing the solvent and nonsolvent coating vehicle fluids
under conditions in which the solvent volatilizes at a rate
substantially faster than that of the nonsolvent. As a result
the polymeric material initially gells in the more nonsolvent-
predominant regions of the layer and isolates the nonsolvent as
droplets substantially uniformly distributed throughout a
matrix of polymeric material. The nonsolvent is subsequently
volatilized from the droplets to yield a like distribution of
mesopore voids throughout said membrane matrix. The porous
membrane is capable of absorbing significant amounts of
electrolyte solution to provide suitable ionic conductivity for
use in rechargeable battery cells. The addition of inert
particulate filler to the coating composition provides further
strength in the body of the membrane and, due to preferential
accumulation of particles in the dispersed nonsolvent droplets,
provides particulate support within the membrane mesopores
which prevents collapse of the voids at cell fabrication
laminating temperatures and thus maintains electrolyte
absorption capability.

