

## Supplementary Information

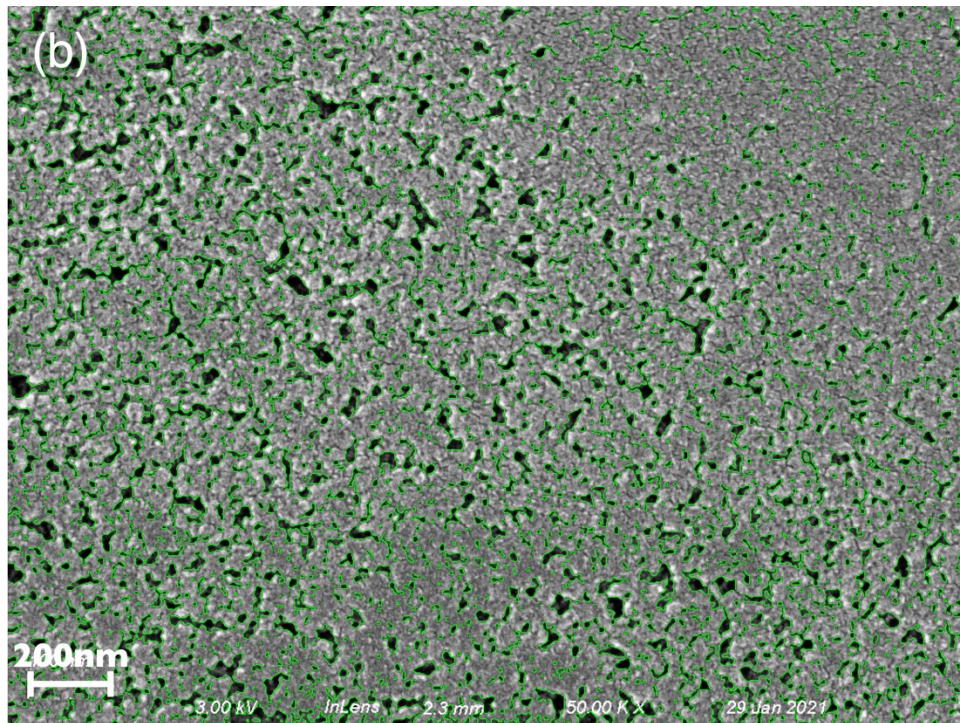
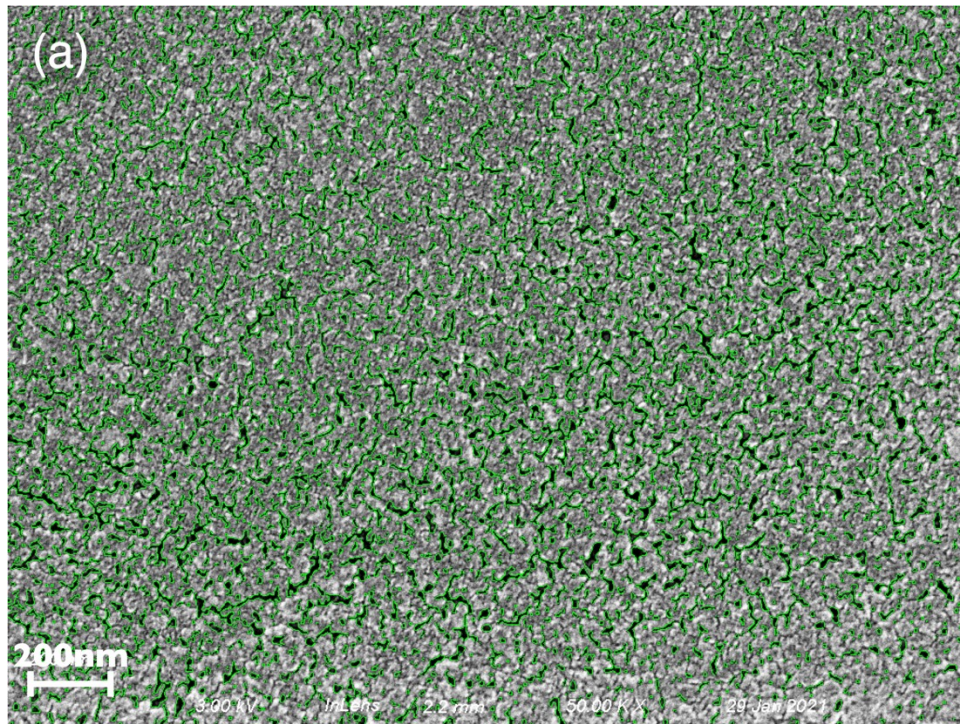
### One-step Fabrication of Robust Lithium Ion Battery Separators by Polymerization-Induced Phase Separation

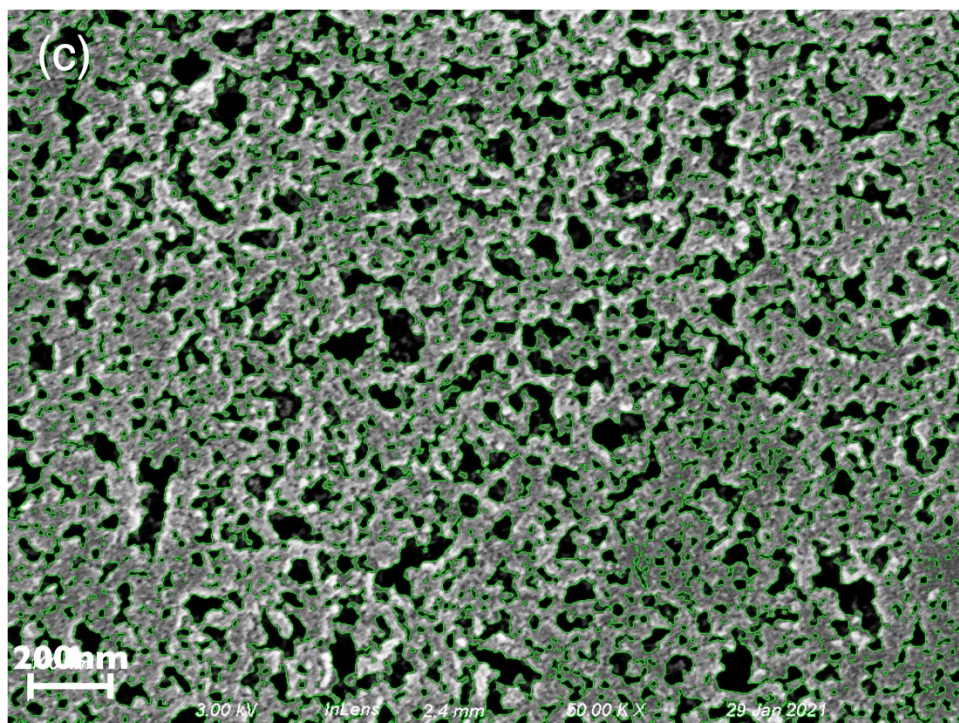
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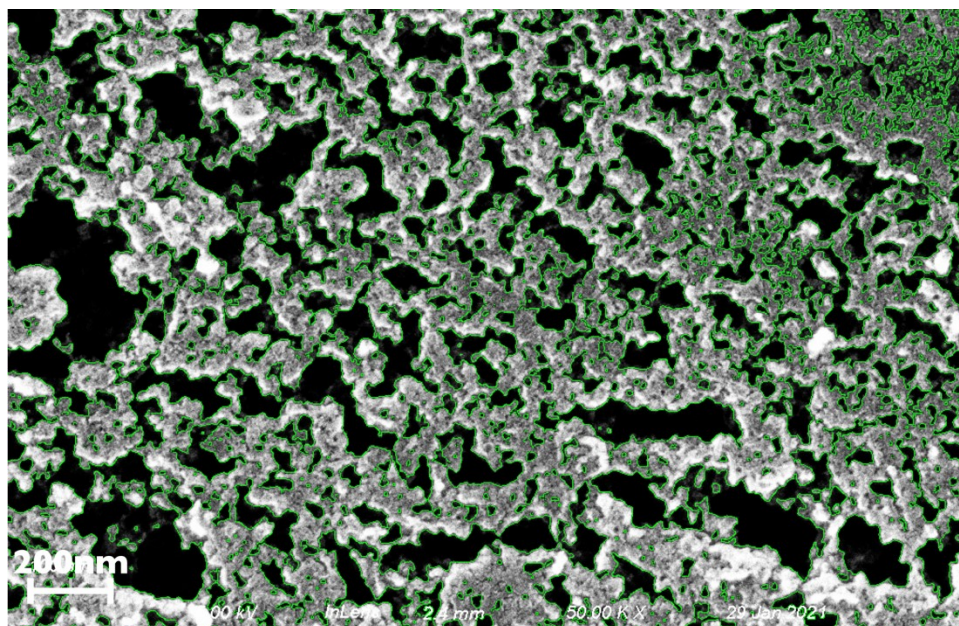
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Rochester, New York 14627, Unites States.

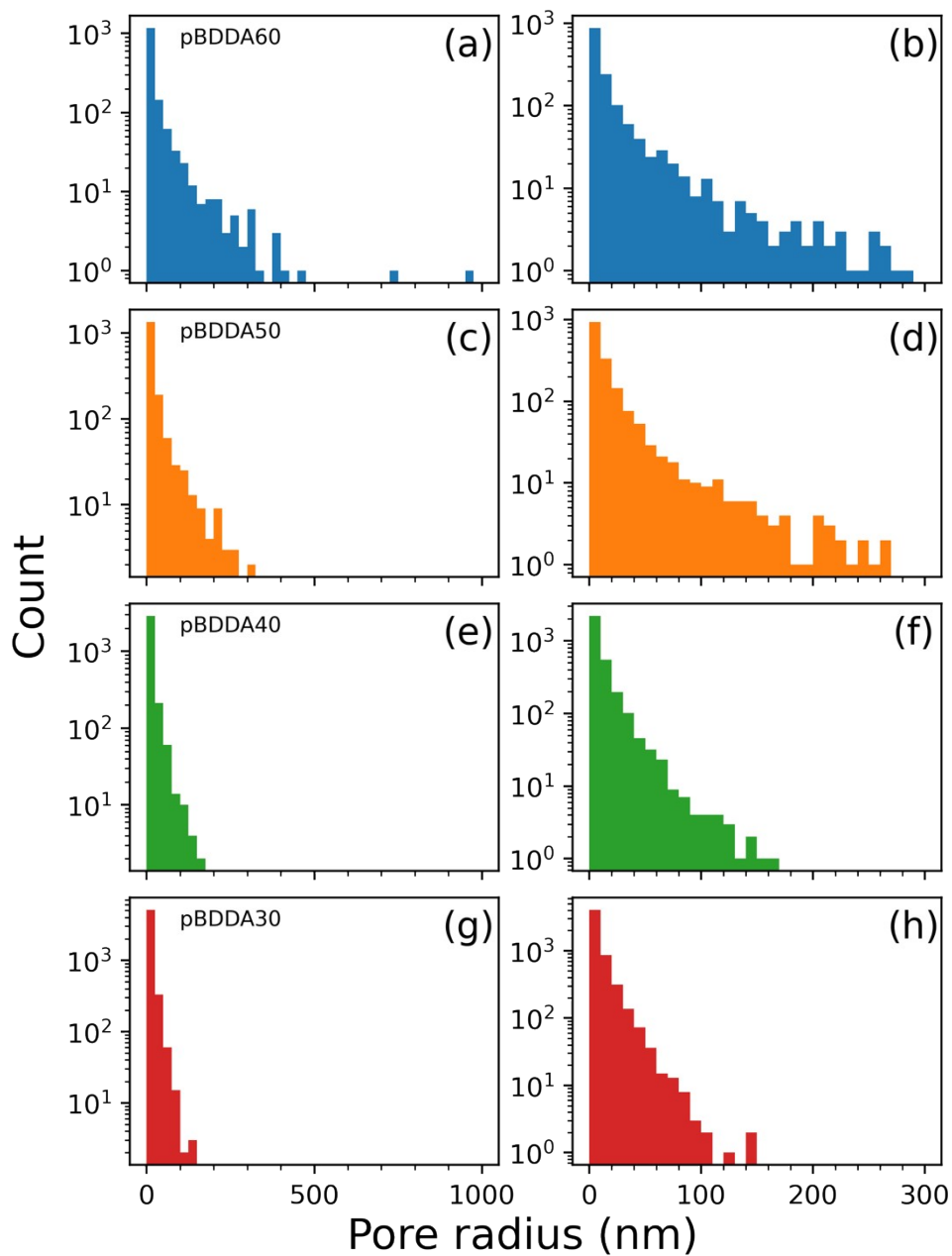
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**Fig. S1** SEM images with algorithmically-detected pore contours overlaid in green for (a) pBDDA30, (b) pBDDA40, (c) pBDDA50 and (d) pBDDA60.





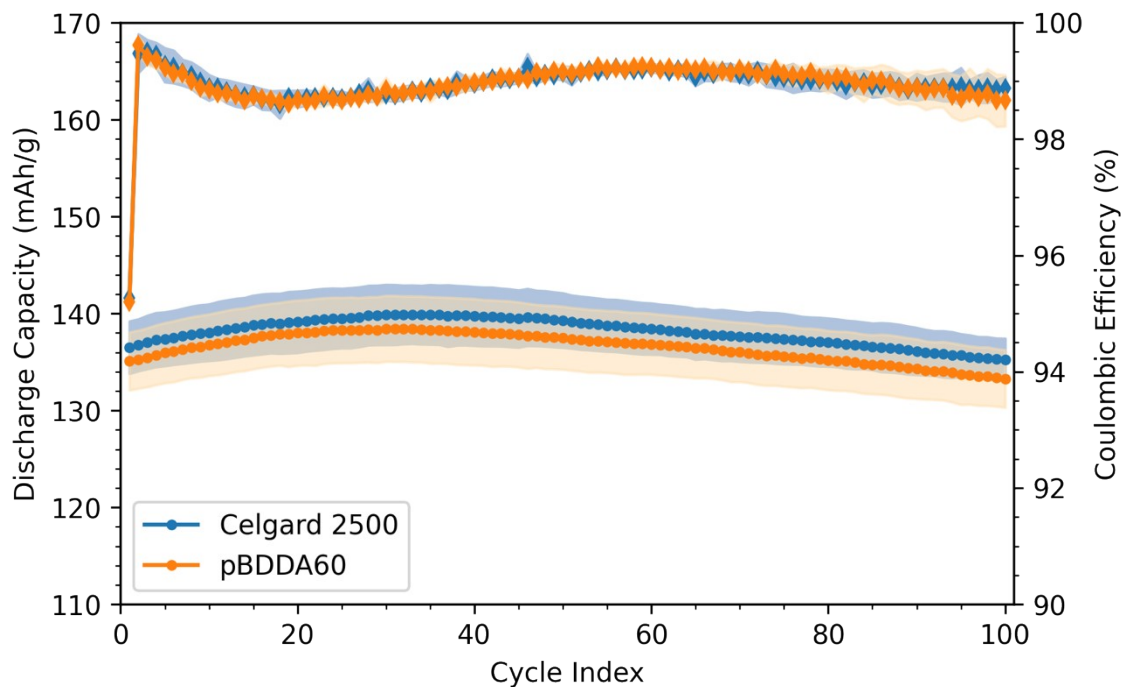
**Fig. S2** Histogram plots for pore size distribution derived from the SEM images of pBDDA samples. Individual plots for (a-b) pBDDA60, (c-d) pBDDA50, (e-f) pBDDA40 and (g-f) pBDDA30 are shown, The plots in the left show the entire range of pore sizes with a bucket width of 25nm. The plots in the right column show only up to 300nm in radius where most of the detected pores are plotted, to achieve a higher resolution – the bucket width is 10nm.

**Table S1** MacMullin numbers ( $N_M$ ) of commercial separators reported in the literature

Separator	Material	$N_M$	Reference
Celgard C480	PP/PE/PP	7.3	63
Celgard H2013	PP/PE/PP	6.9	63
Celgard 2320	PP/PE/PP	10	63
Celgard 2325	PP/PE/PP	10	63
Celgard 2400	PP	13, 15.7, 23	64, 62, 55
Celgard 2500	PP	4.5, 8.5, 16, 23	63, 62, 64, 55
Celgard 2730	PE	11	64
Celgard 3500	PP	6.1	63
-	HDPE	14	63
-	HDPE	16	63
Solupor 14P01A	UHMWPE	22, 22.1	64, 62
Solupor 7P03A	UHMWPE	13, 4.3	64, 62
Solupor 10P05A	UHMWPE	5	64
Hipore N962C	UHMWPE	16.1	62
Hipore N720	UHMWPE	19.3	62
Hipore 6022	UHMWPE	13.4	62
Freudenberg FS-3001-30	PET <sup>‡</sup>	4.6	63

<sup>‡</sup>Non-woven separator

Separators were tested in 1.5M LiAsF<sub>6</sub> in THF<sup>55</sup>, 1M LiPF<sub>6</sub> in 1:1 EC:DMC<sup>62,64</sup>, and 1M LiPF<sub>6</sub> in 3:7 EC:DMC<sup>63</sup>.



**Fig. S3** Average cycling performance of NMC532/Li metal half-cells with 1M 3:7 v/v/ EC:DMC, cycled at C/3 at 30°C. Five cells were tested and averaged for each material. Celgard 2500 separators were 25 $\mu$ m, while pBDDA60 varied in thickness from 22-40 $\mu$ m with an average thickness of 30.2 $\mu$ m.