

Supplementary Information

Figure S1. Bright field TEM images of acidic Nafion. (a,b) images collected at room temperature with 500 e/nm^2 at rate $500 \text{ e/nm}^2 \text{ s}$; (a) from initially undamaged sample; (b) after 10000 e/nm^2 ; (c,d) images collected at cryo-temperature with 300 e/nm^2 at rate $300 \text{ e/nm}^2 \text{ s}$; (c) from initially undamaged sample; (d) after 5000 e/nm^2 .

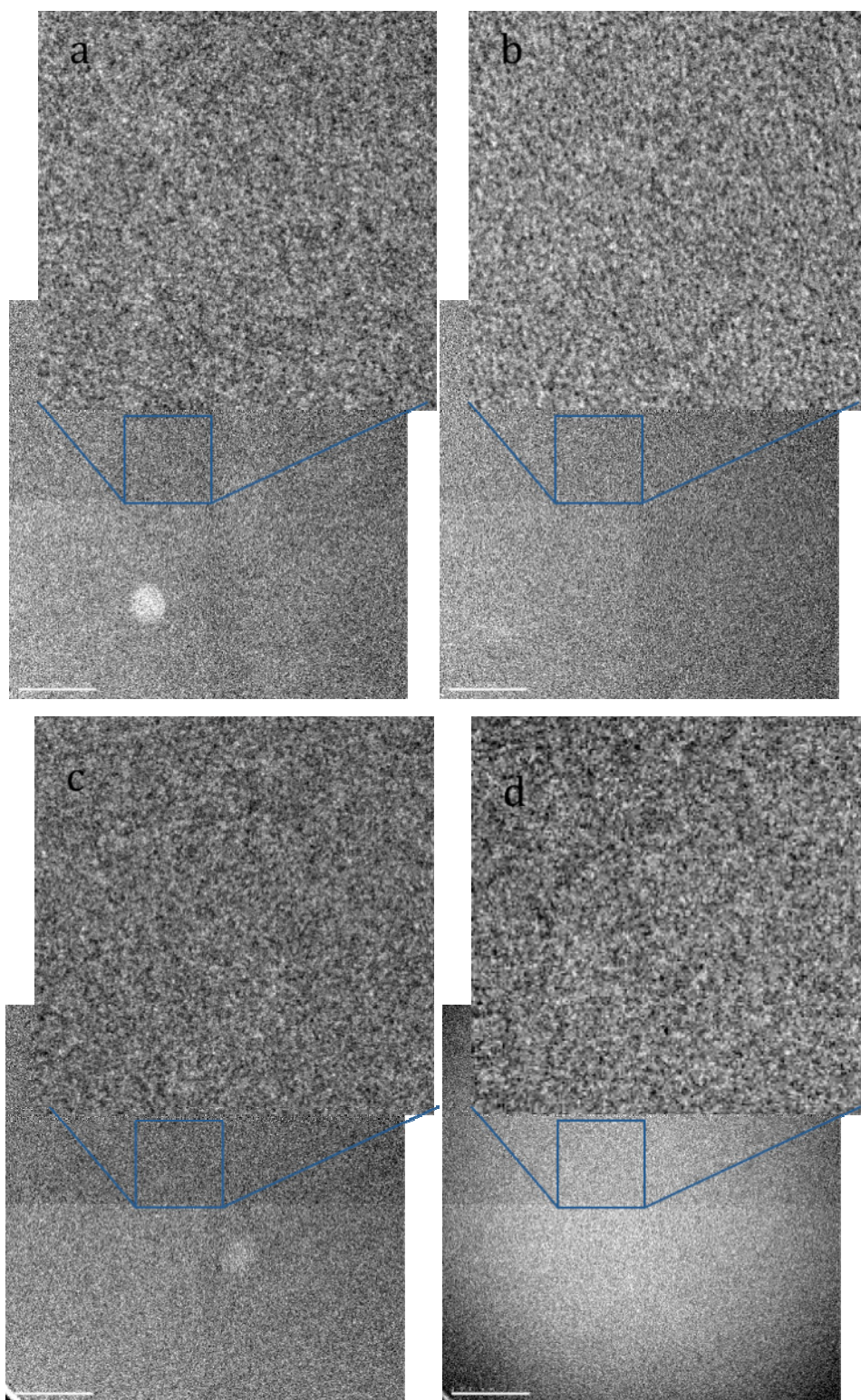
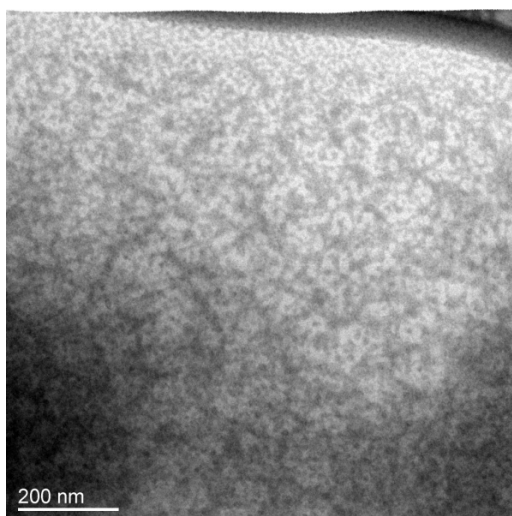


Figure S2. Artifacts in Nafion caused by extended beam irradiation. Sample was exposed to the dose rate of $10000 \text{ e/nm}^2 \text{ s}$ for one minute, resulting in small mass loss after initial thinning but the appearance of substantial phase separation.



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