

Figure S1 Small angle Lorentz correction analysis on $I(q)q^2$ with q for AEM91 at different RH conditions.



Figure S2 Enlarged SAXS profiles in Region 2 for AEM91 equilibrated at RH of 0%, 30%, 50%, 65% and 80% at room temperature. The best-fitted theoretical profile across the ion-related peak by Eq. (6) for each profile is shown using red lines.



Figure S3 Temperature dependence of anion conductivities of AEM91 at different hydration conditions at 25–80 °C.



Figure S4 SAXS profiles measured for AEMs with different GDs at 80% RH at room temperature (a) in absolute intensity units and (b) in an arbitrary units derived by vertically shifting the profiles shown in part (a) to avoid overlapping. The best-fitted theoretical profile across the ion-related peak from Eq. (6) for each measured scattering profile is shown using red lines. The vertical broken lines in both parts indicate the boundary between Region 1 and Region 2.



Figure S5 Small angle Lorentz correction analysis on $I(q)q^2$ with q for AEMs with different GDs at (a) dry and (b) 80% RH states.



Figure S6 Temperature dependence of anion conductivities of AEMs with different GDs at 80% RH at 25–80 °C.



Figure S7 GD dependence of E_a for AEMs with different GDs at 50% RH and in liquid water.