All-Solid-State Nanocomposite Electrolytes Composed of an Ionic Polymer with Polar Groups and Surface-Modified SiO$_2$ Nanoparticles for Dye-Sensitized Solar Cells

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Fig. S1 shows the TEM images of SiO$_2$ nanoparticles in sizes of 7-10 nm and 20-30 nm. Fig. S1a shows KH550-modified SiO$_2$ in size of 7-10 nm, where the inset on the left-top side is the naked SiO$_2$ nanoparticles in size of 7-10 nm. KH570-modified SiO$_2$ nanoparticles in size of 20-30 nm are shown in Fig. S1b, where the inset on the left-top side is the naked SiO$_2$ nanoparticles in size of 20-30 nm.

![Fig. S1 TEM images of (a) modified SiO$_2$ in sizes of 7-10 nm with the inset of naked SiO$_2$ in sizes of 7-10 nm and (b) modified SiO$_2$ in sizes of 20-30 nm with the inset of naked SiO$_2$ in sizes of 20-30 nm.](image)

Fig. S1 TEM images of (a) modified SiO$_2$ in sizes of 7-10 nm with the inset of naked SiO$_2$ in sizes of 7-10 nm and (b) modified SiO$_2$ in sizes of 20-30 nm with the inset of naked SiO$_2$ in sizes of 20-30 nm.

Fig. S2 shows the FT-IR spectra of 2,3-dichloropropionic and ionic polymer. The band at about 630 cm$^{-1}$ is attributed to the vibration of –COOR. The characteristic peak at 704 cm$^{-1}$ is ascribed to C-Cl bond. The peaks at ~770 cm$^{-1}$, ~840 cm$^{-1}$, ~900 cm$^{-1}$, and ~1000 cm$^{-1}$ are attributed to the vibration of C-H, C-O-C, C-N, and stretching vibration of C-O, respectively.

![Fig. S2 FT-IR spectra of 2,3-dichloropropionic and ionic polymer.](image)
Fig. S2 FT-IR spectra of 2,3-dichloropropionic and ionic polymer.

Fig. S3 shows the TGA curves of modified SiO$_2$ particles. Modified SiO$_2$ particles (a-KH570, b-KH570, and a-KH550) do not have a distinct weight loss before 200 °C. For modified SiO$_2$ particles of the same size (7-10 nm), the weight loss of a-KH550 and a-KH570 from 200 to 800 °C are 8.05 wt% and 9.08 wt%, respectively. The weight loss of b-KH570 from 200 to 800 °C (in size of 20-30 nm) is 7.14 wt%.

![TGA curves of a-KH570, b-KH570, and a-KH550.](image)

Fig. S3 TGA curves of a-KH570, b-KH570, and a-KH550.