Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

SUPPORTING INFORMATION

The critical importance of the ionomer on the electrochemical activity of platinum and platinum-free catalysts for anion-exchange membrane fuel cells

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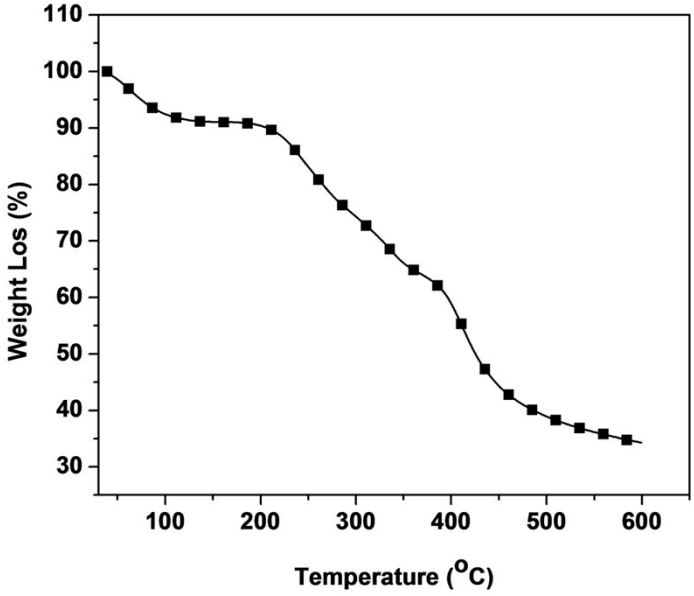

Figure S1. TGA curve of PPO-TMA in the temperature range of 30 to 600 °C. The measurement was performed under N_2 flow. The weight loss between 30 and 100°C is assigned to residual water. The PPO-TMA starts decomposing at *ca* 210°C, much earlier than pure PPO (*ca* 400°C). This is in line with TGA results reported for other AEIs based on a PPO polymer backbone, and in particular for another PPO functionalized with TMA cationic group.[S1-S2]

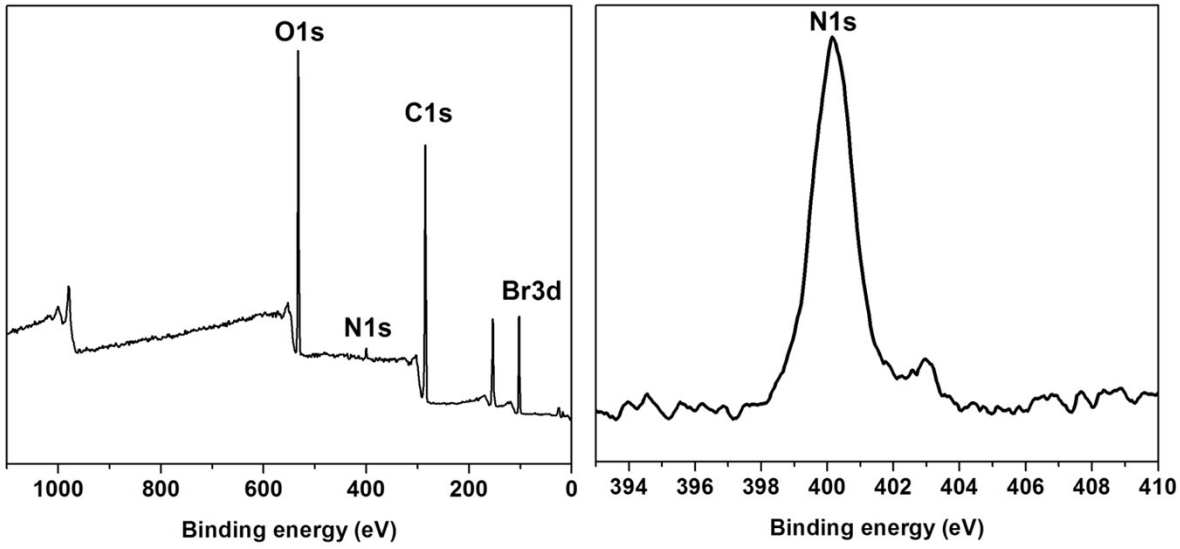

Figure S2. XPS survey spectrum and high resolution spectrum of N1s region of PPO-TMA in bromide form.

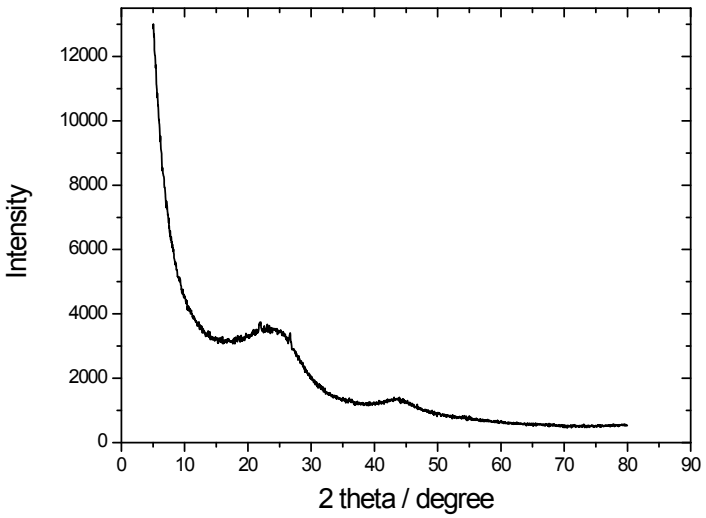

Figure S3. XRD pattern of $Fe_{0.5}$-950. The pattern shows only two broad peaks assigned to the amorphous carbon matrix with nanosized graphite crystallites.

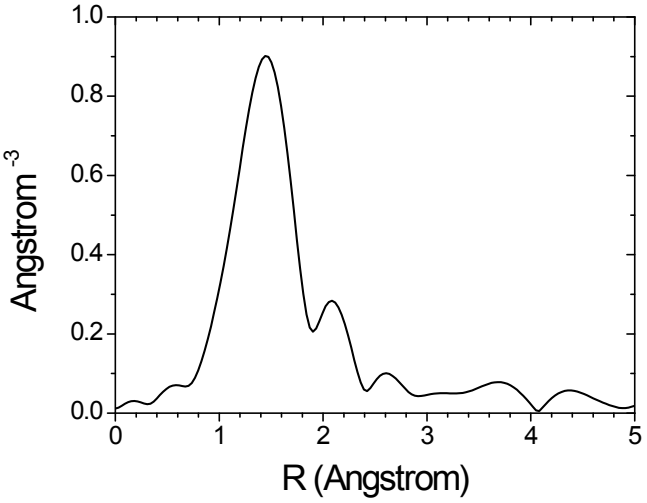

Figure S4. *Ex situ* Fe K-edge EXAFS spectrum of $Fe_{0.5}$-950. The spectrum was recorded in air at room temperature. The distance is not corrected for phase-shift. The signal at 1.5 Å is assigned to Fe-N or Fe-O interaction from FeN_x sites and O_2 adsorbed on Fe from such sites, at 2.2 Å is assigned to Fe-Fe interaction from a minor fraction of Fe having formed particles during the pyrolysis in NH_3, and at 2.6 Å is assigned to Fe-C interactions between Fe from FeN_x sites and C atoms from the second coordination sphere. This result is similar to our previous publication (Ref. 45, Fe-N-C sample prepared similarly to the present $Fe_{0.5}$-950 catalyst), where EXAFS assignments have been discussed also on the basis of a rigorous fitting procedure.

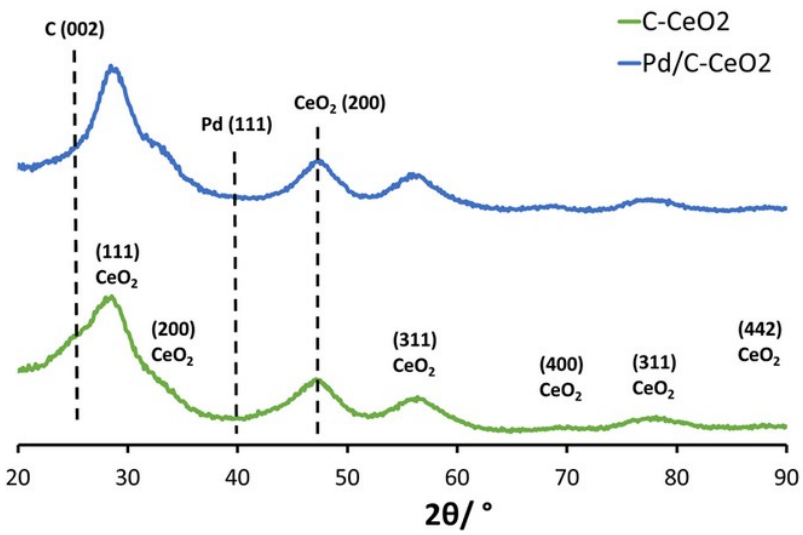

Figure S5. XRD patterns for CeO_2/C and Pd-CeO_2/C. Both patterns show only the reflections from the cubic structure of CeO_2 with the large FWHM consistent with nanosized CeO_2 particles. No signal for metallic Pd is visible in the pattern of Pd−CeO_2/C, indicating non-crystalline and/or high dispersion of palladium in this catalyst.

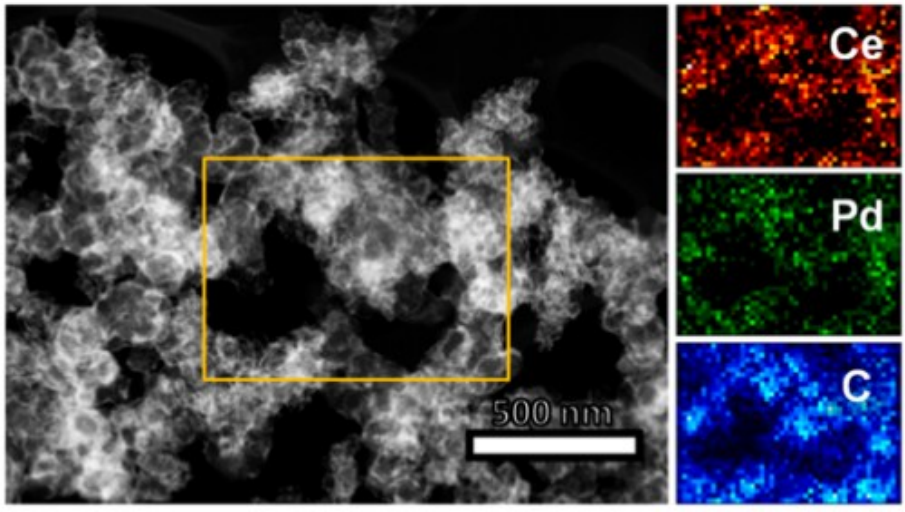

Figure S6. STEM images of Pd−CeO_2/C. HAADF image and STEM-EDS elemental mapping of the selected area (highlighted by orange rectangle on the left) showing Ce (red), Pd (green) and carbon (blue) elemental distribution. Reprinted with permission from *ACS Appl. Energy Mater.*, 2019, **2**, 4999–5008. Copyright (2019) American Chemical Society.

Supporting references

S1. H.-S. Dang and P. Jannasch, *J. Mater. Chem. A,* 2016, **4**, 11924-11938.

S2. H.-S. Dang and P. Jannasch, *Macromolecules*, 2015, **48**, 5742−5751.