Supporting Information

Oxygen reduction reactivity of precisely controlled nano-structured model catalysts

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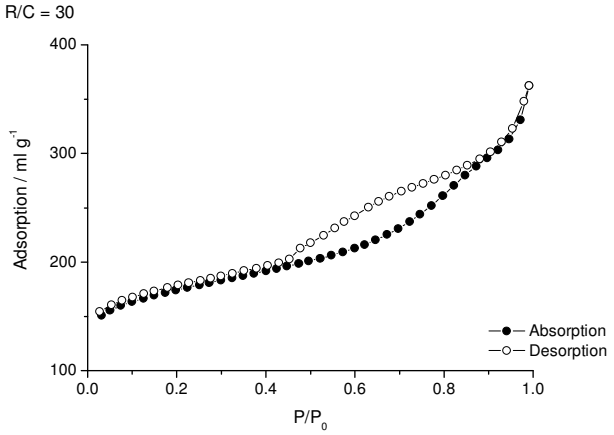
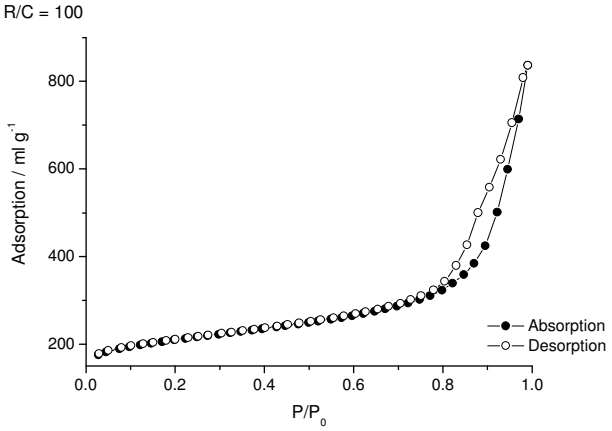
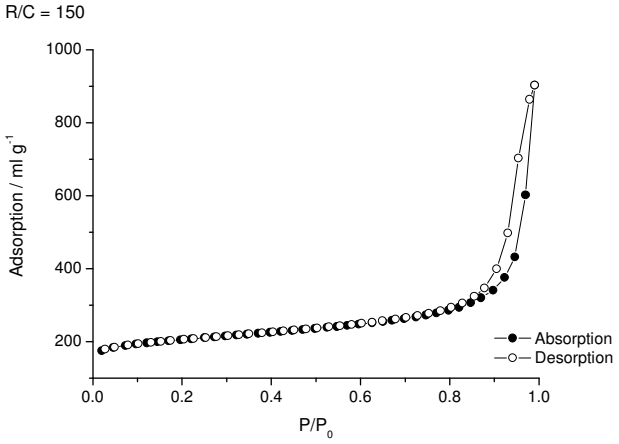
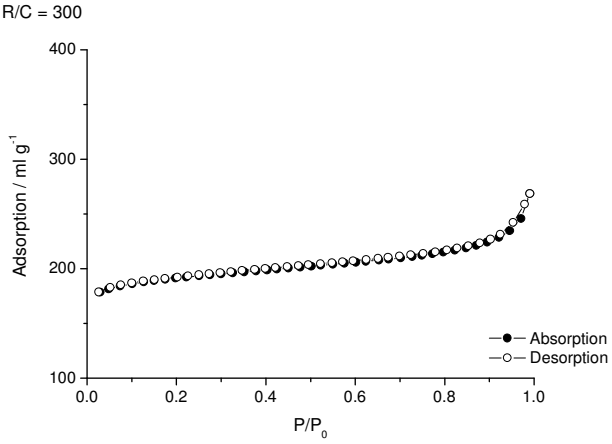
S1 N_2 adsorption – desorption isotherms of CAG at 77 K.

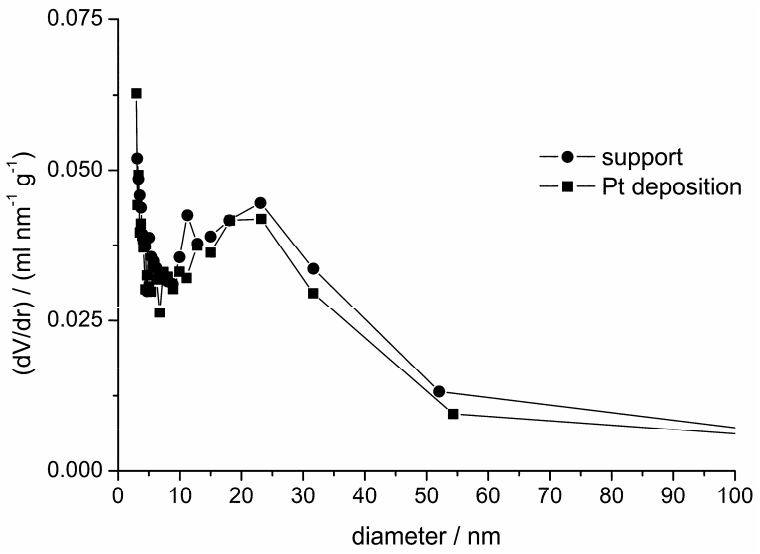


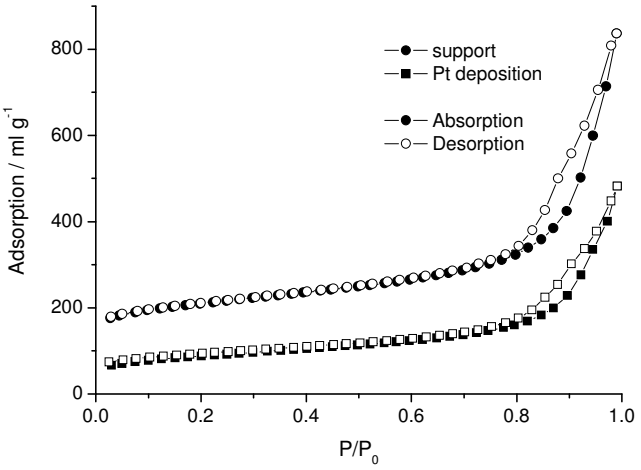




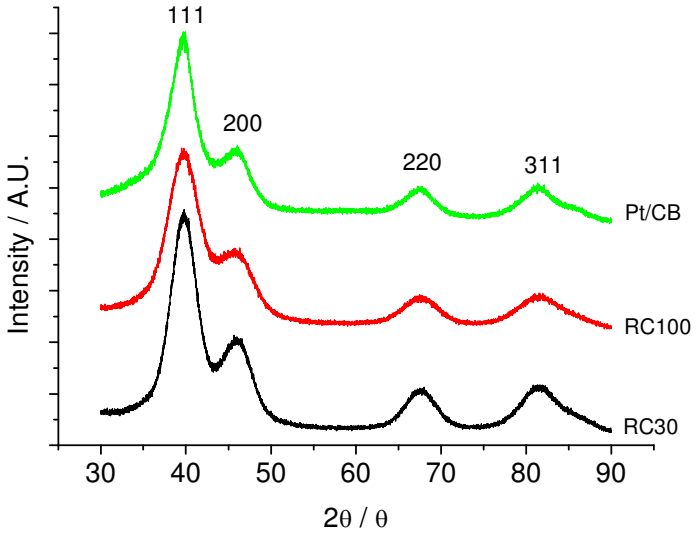


S2 Obtained pore distributions using BJH method from N_2 adsorption isotherm of CAG support (R/C = 100, before deposition) (●) and RC100 (after platinum deposition) (■) (upper graph), and N_2 adsorption – desorption isotherms at 77 K (lower graph).



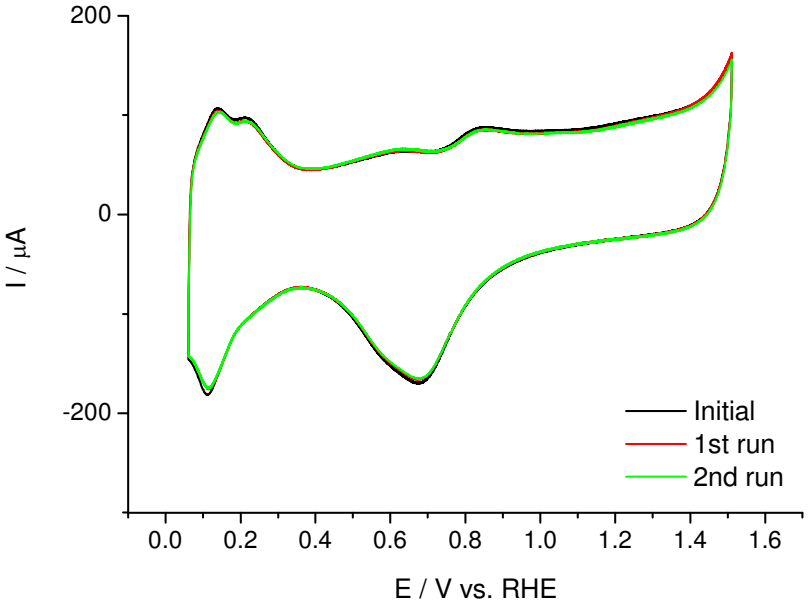


S3 XRD patterns of Pt/CAG catalysts and Pt/CB. The measurements were performed using CuKα radiation.



S4 Change in electrochemical surface area of RC100 without any ionomers.

Cyclic voltammograms of thin film electrode of RC100 without any ionomer under Ar saturated 0.1 mol dm^{-3} $HClO_4$ solution at room temperature. The amount of platinum on the electrodes was 2.8 μg (14 μg cm^{-2}). The sweep rate was 50 mV s^{-1}. The electrochemical surface areas slightly changed, and were 36.8 (initial: before RDE measurement), 35.7 (1st run: after 1st RDE measurement), and 35.2 m^2/g (2nd run: after 2nd RDE measurement). The ECSAs decreased a few percent after the measurement (RDE), *i.e.*, 3.0 % (1st run) and 4.3 % (2nd run) less from the initial surface area, and these values were much smaller than the difference in the ECSA between with and without an ionomer.



S5 XPS analysis of the electrode with CHF_3SO_3 (C1).

The figure shows the F1s spectrum of the electrode before (a) and after (b) the electrochemical measurement (dipping the electrode into electrolyte solution). From the X-ray photoelectron spectroscopy (XPS) measurement of the electrode with C1 based on the F1s signal, the mass amount of C1 (trifilic acid) became 1/30 of the initial amount after the electrochemical measurement. This amount corresponds to a 1-2 nm thickness if the density of C1 is the same as Nafion. Furthermore, it means that the electrolyte solution can penetrate into the pores. In this experiment system (thin layer electrode), if the electrolyte solution contacts the surface of the platinum particles in the pores, the catalyst would become active for the ORR.