Supporting Information

Unveiling the Particle Size Effect and Surface Reactivity of Pt/C Nanoparticles for Ammonia Electrooxidation using In-situ Infrared Spectroscopy

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Cyclic voltammetry was used to analyze ammonia electrooxidation using synthesized Pt/C nanoparticles in 1M KOH. Cyclic voltammetry comparisons in 1 M KOH for Pt 1.3, 2.2, 2.9, and 4.3 nm are shown in Figure S-1. The 10^{th} cycle is shown in the potential range of 0 to -0.9 V vs. Hg/HgO at 20 mVs^{-1}. The current was normalized by the electrochemical surface area (ECSA) obtained from the integration of the surface under the CV in the adsorption/desorption region in 1 M KOH divided by 210 $\mu C\ cm^{-2}$ which is the theoretical charge required to remove a monolayer of H atoms from the platinum surface.

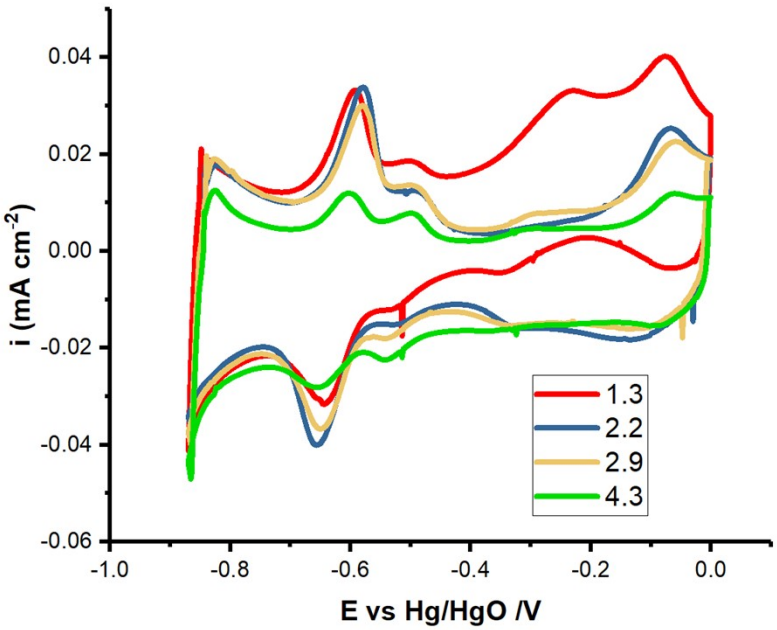

Figure S-1: Cyclic voltammetry of Pt/C NPs of 1.3, 2.2, 2.9, and 4.3 nm average size in 1M KOH at 20 mVs^{-1}

A comparison of CVs and a forward scan of CVs in ammonia containing solution is shown in Figure S-3. Pt/C with the smallest particle mean size with 1.3 nm has showed the relatively highest current density. Activity decreases with increase of the particle size which illustrates a direct relation between size and the catalytic activity of Pt nanoparticles in this reaction.

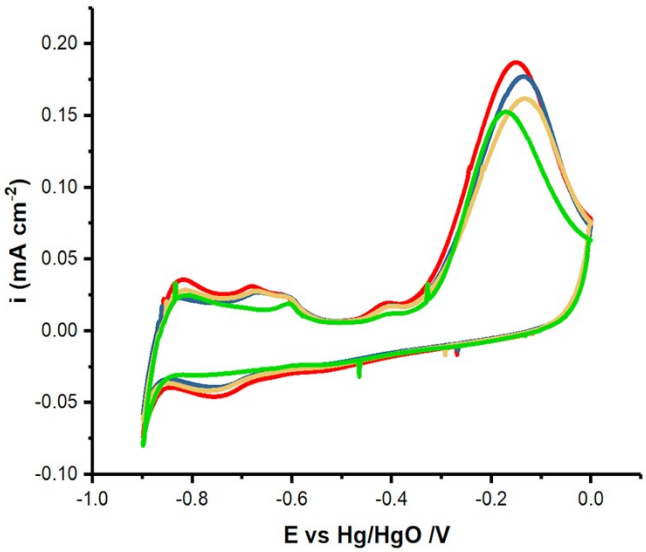

Figure S-2 Cyclic voltammetry of Pt 1.3 nm, Pt 2.2 nm, Pt 2.9 nm and Pt 4.3 nm in 1 M KOH + 0.5 M NH_4OH at scan rate of 20 mV s^{-1}

Prior to collecting the spectra, PM-IRRAS chamber was purged with N_2 (Linde, 99.99%) to remove any CO_2 that could be present from the air and the spectra were taking at intervals of 15, 30, 45, 60, and 75 minutes to follow the CO_2 peak at ~2400 cm^{-1}. Figure S-3 shows that the sensitivity was clearly visible both before and after purging. Before each experiment the chamber was purged with N_2 for 60 min.

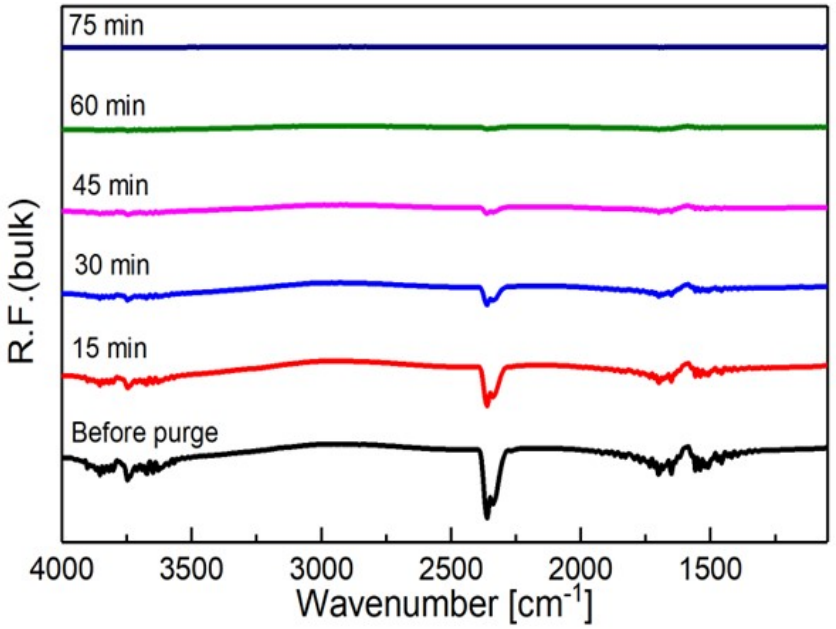

Figure S-3: Purging the IRRAS chamber for different period of time to insure that all CO_2 is removed from the chamber.