CO tolerance and stability of graphene and N-doped graphene supported Pt anode electrocatalysts for polymer electrolyte membrane fuel cells

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Supporting information

Cyclic voltammetry, CO stripping and repetitive potential cyclic

Cyclic voltammetry (CV), CO stripping (SCO) and repetitive potential cyclic (RPC) were carried out in the unit cell, adapted for a half-cell, using the anode as work electrode filled with Ar and CO (for the SCO), the cathode was supplied with H_2 employed as a reference electrode (RHE), using a potentiostat/galvanostat Solartron 1285 (Solartron analytical, Leicester, England). The gases during every measure were under constant flux.

Cyclic voltammetry

1. The unit cell was adapted for a half-cell to carry out the measures of CV, SCO, and RPC. The anode was filled with Ar and H_2 as RHE in the cathode for 15 min to guarantee a clean gas atmosphere during the measures.

2. Initially, were measured 3 voltammograms from 0.075 to 0.8 V at 50 mV s^{-1} vs RHE.

3. After 300 s were measured 3 voltammograms from 0.075 to 1.2 V at 20 mV s^{-1}, and 3 voltammograms from 0.075 to 0.8 V at 20 mV s^{-1} vs RHE.

4. After 300 s were measured 3 voltammograms from 0.075 to 0.8 V at 10 mV s^{-1} vs RHE.

CO stripping measurements

1. After cyclic voltammetry, the SCO measures were carried out by cyclic voltammetry, supplying by 20 min of CO and promptly changed for 40 min of Ar on the anode, while the cathode was filled only with H_2.

2. Immediately, after 40 min of Ar, was measured a cyclic voltammetry from 0.075 to 0.9 V at 10 mV s^{-1} vs RHE, to measure the CO desorption on the anode.

3. Two additional voltammetries were measured with Ar on the anode, from 0.075 to 0.9 V at 10 mV s^{-1} vs RHE, at the SCO conditions to subtract the oxidation currents attributed to CO desorption.

Repetitive potential cyclic

1. After CO stripping tests, the anode was filled with Ar and the cathode with H_2 with constant flux during 15 min, before to start the RPC.

2. The RPC was measured under the constant flux of gases, applying 5000 cycles from 0.075 to 0.7 V at 50 mV s^{-1} vs RHE.

After Repetitive potential cyclic, the cyclic voltammetries and CO stripping tests were measured at the same initial conditions described to compare each catalyst before and after RPC.