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Fuel cell technology enables clean and efficient energy conversion with high energy density. So far, this promising technology has not penetrated the market to compete with conventional power sources. The reasons are mainly found in the high costs of the system. A major portion of the costs of polymer electrolyte membrane fuel cells (PEMFC) is represented by the costs of the catalysts, which are made of pure platinum in the current state of the art. By the appropriate combination of Pt with transition metals, it is possible to significantly increase the activity of the catalyst.

Alloys of platinum with transition metals such as Co, Ni, Cu, V and Ti have been found to show higher electrocatalytic activities towards the oxygen reduction reaction (ORR) than platinum alone. The enhancement of the catalysts activities has been ascribed to (1) geometric factors, (2) dissolution of the non-noble metal component, (3) change of surface structure or (4) electronic factors.

## Catalyst preparation

Pt-Co binary electrocatalysts with different Pt:Co stoichiometries were prepared by impregnation of previously fabricated gas diffusion electrodes with a solution containing the appropriate amounts of hexachloroplatinic acid, cobalt acetate and ethylene glycol. After deposition of the metal salt containing solution onto the GDE a mild thermal treatment step in the range of 180-240 °C was performed.

## Electrode preparation

In order to prepare the rotating disc electrodes 2 cm<sup>2</sup> of the impregnated gas diffusion electrodes were suspended in isopropanol and treated in an ultrasonication bath to form a homogeneous catalysts dispersion. A 10 µl aliquot of the dispersion was dispensed onto a glassy carbon rotating disc resulting in a Pt loading of 28 µg Pt/cm<sup>2</sup> geometric surface area.

## Electrochemical measurements

The electrochemical characterisation of the catalysts was carried out using a Autolab PGSTAT302N potentiostat and a rotator from Pine Industries. As electrolyte 0.1 M HClO<sub>4</sub> was used and all measurements were conducted at room temperature.

## Oxygen Reduction Reaction Activity

The activity of the prepared Pt-Co electrocatalysts towards the oxygen reduction reaction was measured by scanning the electrodes between the potential of 0.050 and 1.055 V in oxygen-saturated 0.1 M HClO<sub>4</sub> at a scan rate of 50 mV/s. During measurement the oxygen supply was sustained to keep the oxygen concentration in solution at a constant level. The Rotating speed was 1600 rpm.

Pt-Co binary electrocatalysts were characterised by cyclic voltammetry in HClO<sub>4</sub> (Fig.1) and the electrochemical active surface area (ECSA) was determined by integration of the hydrogen-adsorption/desorption reaction (H<sub>upd</sub>).

Fig. 2 depicts the obtained ORR polarisation curve of catalyst sample with a stoichiometry of Pt:Co of 1:5 at 1600 rpm in HClO<sub>4</sub>.

Referring to the reported specific activity of pure platinum of about 0.2 mA/cm<sup>2</sup> Pt the obtained Pt-Co catalysts show a 2-4fold activity enhancement for the ORR at a potential of 0.9 V.

Further investigations to determine the catalyst's composition, degree of alloying and morphology are currently in progress.

**Table 1: Results of the electrochemical characterisation**

Electrochemical Active Surface Area	197 cm <sup>2</sup> /mg Pt
H <sub>upd</sub> Charge	0.230 mC
Current @ 0.9 V (1600 rpm)	-0.306 mA
Diffusion Limiting Current	-0.965 mA
Specific Activity @ 0.9 V	0.420 mA/cm <sup>2</sup> Pt

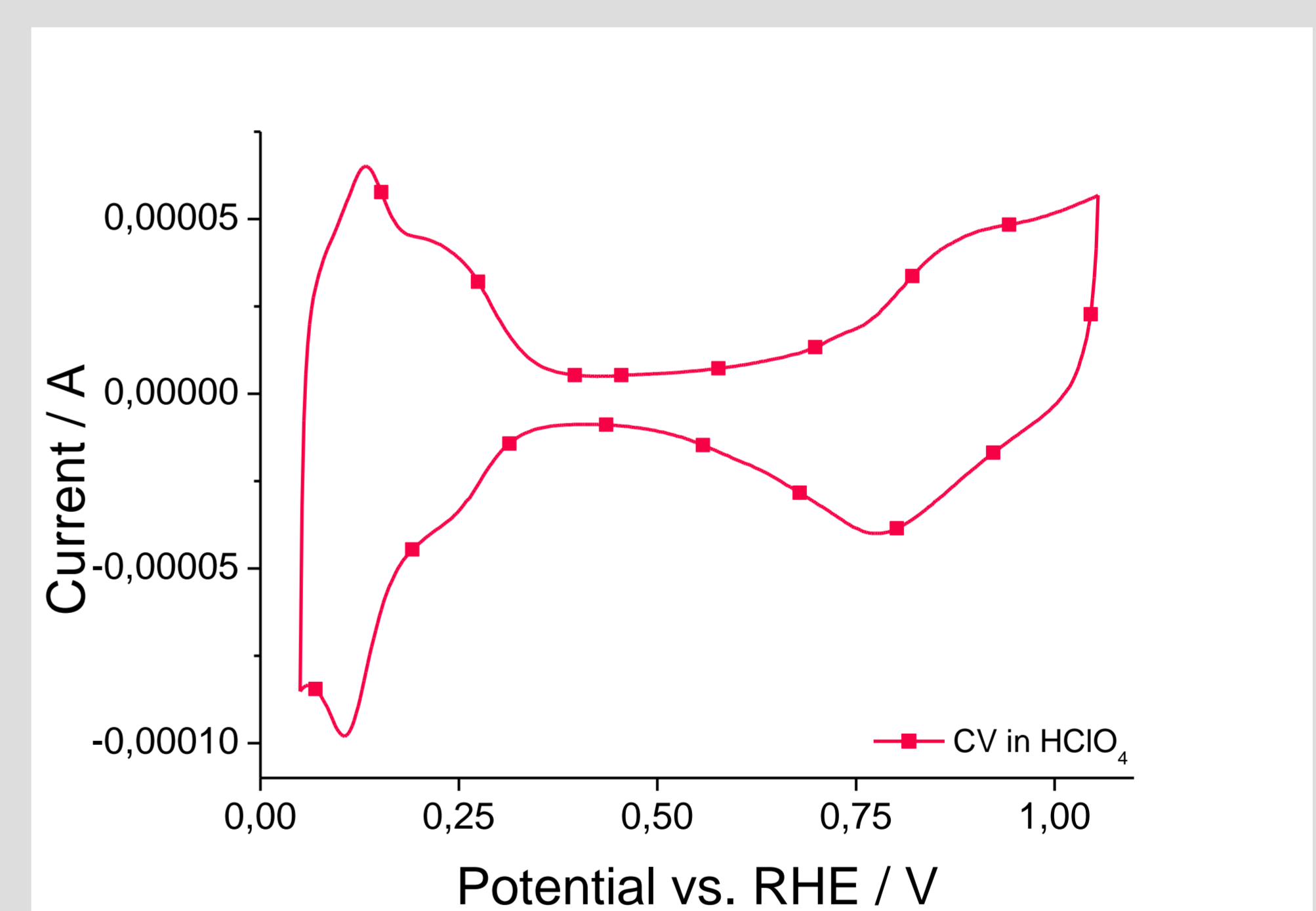


Figure 1: CV profile of a Pt-Co catalyst sample in HClO<sub>4</sub>

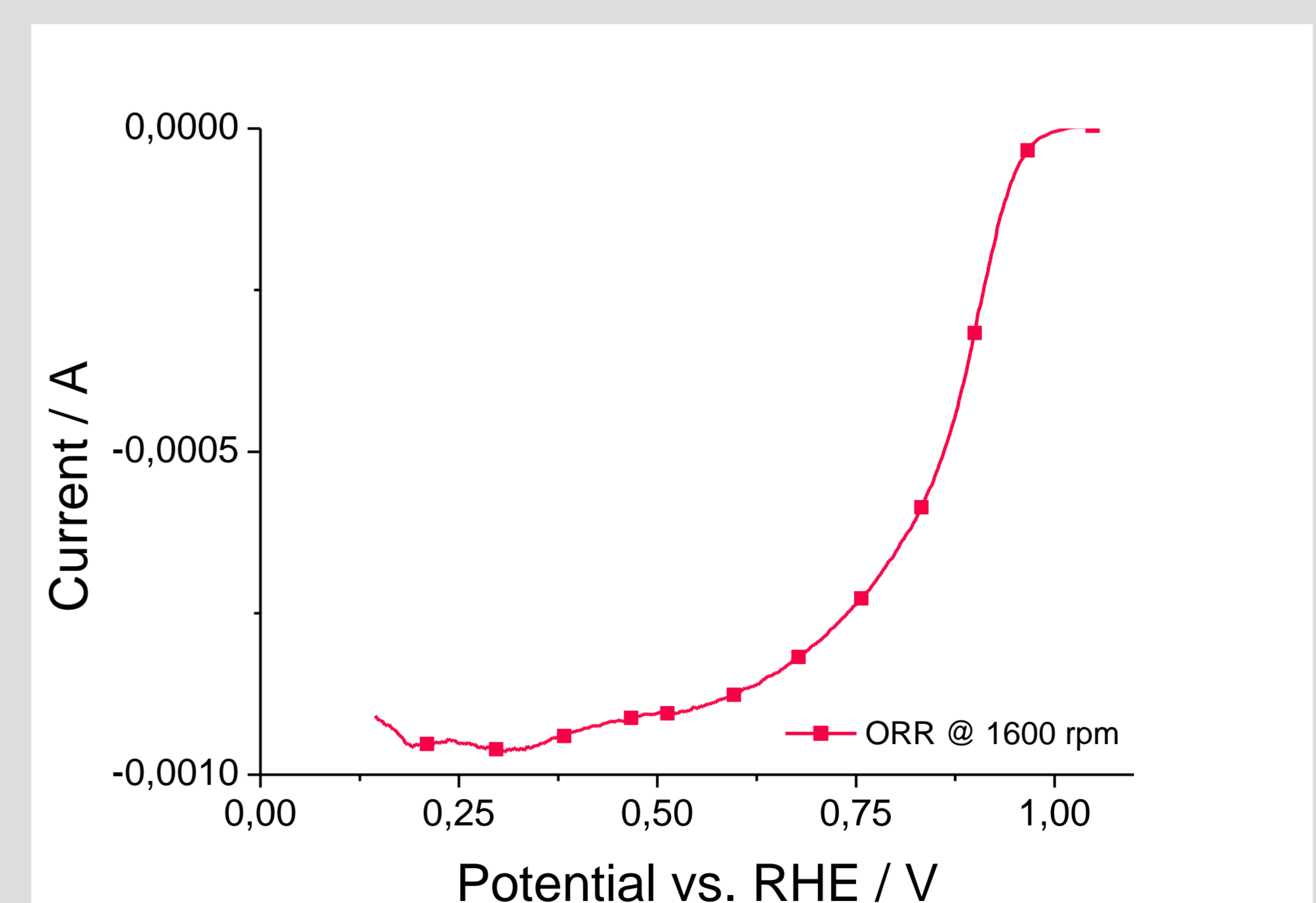


Figure 2: ORR profile of a Pt-Co catalyst sample in HClO<sub>4</sub> at 1600rpm