

# PtCu/C Electrocatalyst Activated by Chemistry Dealloying for Electrochemical Oxidation of Hydrazine

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## Abstract

Skeletal-type Pt/C has been proposed as catalyst for hydrazine electrooxidation with improved performance.

## Introduction

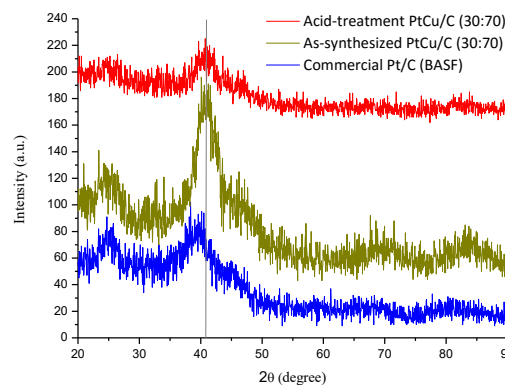
Koh and Strasser<sup>1</sup> reported a significant activity enhancement for the oxygen reduction reaction after electrochemical dealloying of carbon-supported PtCu alloy nanoparticle. After removal of Cu atoms from the surface region, the resulting catalyst showed an improvement of activity compared to pure Pt.

In this study, PtCu/C electrocatalyst (carbon-supported PtCu alloy) was prepared by hydrazine reduction and the obtained material was treated with nitric acid to remove Cu atoms by chemical leaching in order to obtain a carbon-supported Pt alloy skeletal-type electrocatalyst. The obtained material was tested for hydrazine electrooxidation.

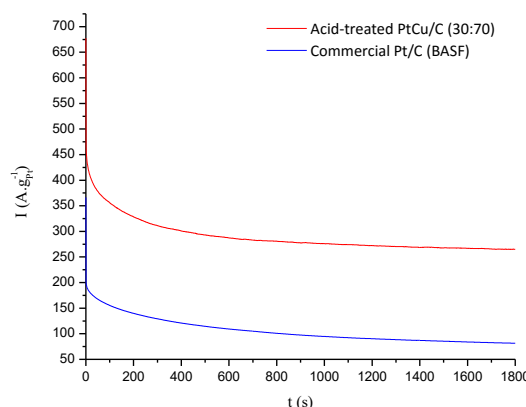
## Results e Discussion

The XRD diffractogram of the as-synthesized PtCu/C electrocatalyst (Figure 1) showed a broad peak at about 25°, which was associated to carbon and three diffraction peaks at 2θ angles around 42°, 67° and 82°, which are characteristic of the face-centered cubic (fcc) structure of Pt.<sup>2</sup> A detailed observation of these reveals a shift to higher angles compare to Pt/C, indicative of the PtCu alloy formation. After the acid treatment, the X-ray diffractogram of the PtCu/C electrocatalyst showed that the Pt (fcc) structure was preserved.

The chronoamperometric curves of acid-treated Pt<sub>30</sub>Cu<sub>70</sub>/C and commercial Pt/C electrocatalysts in 0.1 mol L<sup>-1</sup> hydrazine and 0.5 mol L<sup>-1</sup> HClO<sub>4</sub> at 0.5 V for 30 min are shown in Figure 2. The acid-treated PtCu/C was more active for hydrazine electrooxidation than the commercial Pt/C electrocatalyst. The increase in the electrocatalytic activity could be attributed to the acid treatment that remove part of the non-noble metal of PtCu/C electrocatalyst, creating new structural arrangements and/or more active crystallographic facets of Pt atoms at the nanoparticle surface.<sup>1</sup>



**Figure 1.** X-ray diffractograms of as-synthesized PtCu/C (30:70), acid-treatment PtCu/C (30:70) and commercial Pt/C (BASF) electrocatalysts.



**Figure 2.** Current-time curves at 0.5 V for acid-treated Pt<sub>30</sub>Cu<sub>70</sub>/C and commercial Pt/C electrocatalysts in 0.1 mol L<sup>-1</sup> hydrazine in 0.5 mol L<sup>-1</sup> HClO<sub>4</sub>.

## Conclusions

The preliminary results showed that the carbon-supported PtCu alloy with low platinum content, after chemical dealloying, has high activity to hydrazine electrooxidation.

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<sup>2</sup>Crisafulli, R.; Antoniassi, R.M.; Neto, A. O.; Spinacé, E.V. *Int. J. Hydrogen Energ.* **2014**, *39*, 5671.