Electrochemical functionalization of porous electrodes for electrocatalytic applications

Q. de Radiguès, F. Van Wonterghem, R. Santoro and J. Proost
quentin.deradigues@uclouvain.be

Introduction

Nowadays, electrocatalysts are deposited onto a substrate in order to reduce the use of expensive precious metals. A porous substrate allows to decrease the size of installations due to the high specific surface area. This work explores the possibility of depositing thin layers of precious metals on porous electrodes using electrodeposition methods. The porous electrode used is Reticulated Vitreous Carbon (RVC) for it is a low cost and chemically inert material.

As copper is typically used as model metal, platinum has been used as catalyst for both hydrogen production and oxidation in fuel cells. Palladium is a catalyst used for the electrochemical destruction of persistent organic pollutants such as PCB, DDT and HCB.

Experimental details

- RVC: 30 and 100 ppi, A = 18 and 66 cm²/cm³
- Initial concentration: aimed at 300, 110 or 30 mg/L
- 0.5M HCl for Cu and Pd - 0.5M H₂SO₄ for Pt
- Batch-recycle mode: Q = 17 → 74 L/h
- Galvanostatic conditions: I = 1 A

Reference electrode: Hg/HgSO₄

Regimes linked to observed potential

<table>
<thead>
<tr>
<th>Regimes linked to observed potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring of the cathode potential vs Hg/HgSO₄, reference electrode revealed a maximum for the experiments using a RVC cathode with higher specific surface (100 ppi). During the second regime, a potential plateau was observed. It is thought to be caused by the potential of the hydrogen evolution reaction.</td>
</tr>
</tbody>
</table>

Conclusions

Galvanostatic metal deposition on porous RVC cathode in flow-by mode in a batch recycle electrochemical reactor showed two kinetic regime. During the second kinetic regime, hydrogen evolution was observed.

Hypothesis that hydrogen evolution damaged Pd deposits could not be confirmed.

The second kinetic regime has been observed to be simultaneous with a potential plateau caused by the hydrogen evolution reaction.

References