

# OXYGEN ELECTROREDUCTION ON PALLADIUM-PLATINUM-ALLOY NANOCUBES IN ACID AND ALKALINE MEDIA

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The kinetics of oxygen reduction reaction (ORR) on PdPt-alloy nanocubes with different metal compositions was studied in acidic (0.5 M H<sub>2</sub>SO<sub>4</sub> and 0.1 M HClO<sub>4</sub>) and alkaline (0.1 M KOH) media using the rotating disk electrode (RDE) technique [1,2]. The PdPt nanocubes were prepared in the presence of polyvinylpyrrolidone and the nominal Pd-to-Pt ratios were chosen to be 34/66, 50/50 and 66/34. The surface morphology of the PdPt alloys was characterised by transmission electron microscopy (TEM). TEM images revealed PdPt nanoparticles had preferential cubic shape with mean particle size of ca. 8-10 nm. The energy dispersive X-ray spectroscopy was employed to determine the real composition of the prepared PdPt alloy nanocubes, which were found to be 36/64, 54/46 and 72/28. CO-stripping and cyclic voltammetry (CV) were used for electrochemical cleaning and characterisation of metal nanoparticles. The CV responses revealed alloy formation.

All the alloyed catalysts showed enhanced electrocatalytic activity for ORR as compared to the monometallic cubic Pd nanoparticles. From the alloyed catalysts Pd<sub>36</sub>Pt<sub>64</sub> exhibited the highest specific activity (SA) in acidic solutions, which in 0.5 M H<sub>2</sub>SO<sub>4</sub> solution was only slightly lower than that of cubic Pt nanoparticles and in 0.1 M HClO<sub>4</sub> it was similar to that found with Pt and Pd nanocubes. Whilst in alkaline solution, the SA value for Pd<sub>72</sub>Pt<sub>28</sub> was about two times higher than that of Pd and Pt nanocubes. The mechanism of O<sub>2</sub> reduction on PdPt alloy nanocubes was similar to that of cubic Pd and Pt catalysts and the ORR proceeded via 4-electron pathway in both solutions.

## References

1. K. Jukk, N. Kongi, K. Tammeveski, J. Solla-Gullón, J.M. Feliu, 2015, *Electrochem. Commun.*, 56, 11.
2. K. Jukk, N. Kongi, K. Tammeveski, J. Solla-Gullón, J.M. Feliu, (Manuscript submitted for publication, 2017).



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