KEMIJSKI INŠTITUT

Vabilo na Preglov kolokvij / Invitation to the Pregl colloquium

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Velika predavalnica Kemijskega inštituta /
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Challenges in the catalysis of fuel cell reactions: Iron or cobalt ions atomically dispersed in nitrogen-doped carbon as competitors of platinum

The oxygen electro-reduction reaction (ORR) is the cathode reaction in fuel cells, envisioned to replace combustion engines for transportation [1]. The first commercial vehicles powered by acidic-type H_2/air polymer fuel cells were released in 2015. The ORR being particularly sluggish, research on novel ORR catalysts is unabated since the 1990's. While novel Pt nanostructures have allowed decreasing the amount of precious metal [2], recent advances in the class of metal-nitrogen-carbon (Me-N-C) catalysts has attracted attention [3-4]. Their development was initially inspired by macromolecules catalyzing ORR in the respiratory system of living organisms. Synthesized at ≥ 700 °C, modern Me-N-C catalysts are the object of intense research regarding the nature/structure of active site and ORR mechanism. Improved durability of Me-N-C catalysts is the next key practical challenge.

This presentation will focus on novel understanding acquired on a recent set of Fe-N-C catalysts comprising, in parallel with atomically-dispersed Fe ions, a controlled amount of iron-based crystalline structures, down to their complete absence. This set of catalysts has proven useful in advancing the understanding of the active site structure, role (or lack of) of Fe crystalline structures, and deactivation/degradation mechanisms [5-6]. Similarities and dissimilarities between Fe- and Co-N-C catalysts will also be discussed on the basis of advanced *ex situ* and recent *operando* spectroscopic characterizations. Remaining key challenges for the implementation of such catalysts in commercial fuel cells will finally be discussed.

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Vljudno vabljeni / Kindly invited