Atomic Layer Deposition of Noble Metal Single Atoms and Nanoparticles for Electrocatalytic Applications

Bilal Bawab, Jhonatan Rodriguez Pereira, Raul Zazpe, **Jan M. Macak**

Center of Materials and Nanotechnologies, Faculty of Chemical Technology, University of Pardubice, Nam. Cs. Legii 565, 53002 Pardubice, Czech Republic,

Central European Institute of Technology, Brno University of Technology, Purkyňova 123, 612 00 Brno, Czech Republic

jan.macak@upce.cz

Platinum group metals such as Pt, Ru, Pd, Ir, etc., have superior performance for various catalytic applications [1]. Due to their scarcity, efforts were being made to reduce the mass/loading or replace these noble metals. Atomic Layer Deposition (ALD) is one among the best technique to facilitate lowering of loading mass on a support of interest [2,3]. Due to the governing surface energy variations between noble metals and support surfaces, the growth initiates as nanoparticles (NP) and with a further increase in ALD cycles the agglomeration among NP's dominates over the individual NP size increase, thus developing thin films of relatively higher thickness.

For electrocatalytic applications, it is important to choose the right substrates. Among available substrates, carbon papers and titania nanotube layers are best choices considering their physio-chemical properties, availability and low costs incurred.

The uniform decoration of these substrates by Single Atoms (Sas), atomic clusters or nanoparticles (NPs) of catalysts proved to be highly efficient in electrocatalysis, as shown in our recent papers [3-6].

The presentation will introduce and describe the synthesis of different noble metal SAs, clusters and NPs by ALD on important substrates. It will also include the corresponding physical and electrochemical characterization and encouraging results obtained in electrocatalysis.

References

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Figure

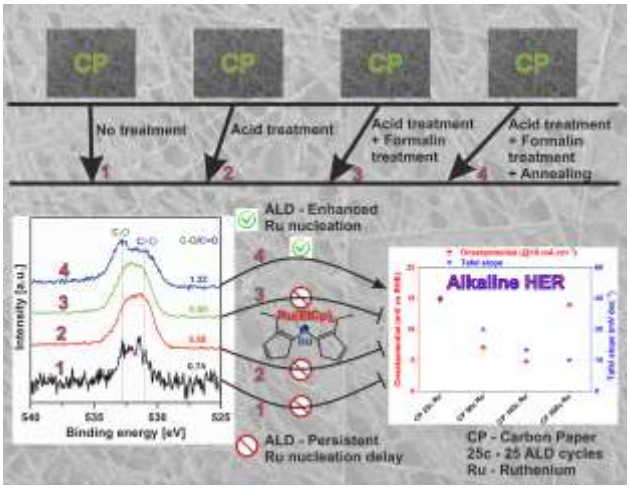

Figure 1. Schematic diagram of Ru ALD nucleation on C substrates with various pretreatment, taken from Ref. [4]