Toward the understanding of electrochemical formation and growth of Nanoparticle

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Nowadays, supporting metal nanoparticles have attracted much interest due to their fascinating physiochemical properties and potential application in fuel cells, sensors, catalysis, solar to fuel devices and among others. One of the interesting issues from engaging physiochemical properties of supporting nanoparticles is to understand their nucleation and growth mechanism in order to get a good control of their structural and morphological parameters. Although studied for decades, however, the full details are still out of reach. In this presentation, we will first review the classical theory of nucleation and growth and secondly present our recent finding and theoretical development on the early stage electrochemical metal nanoparticle formation and growth using a combined experimental (linear sweep voltammetry, chronoamperommetry, FESEM and TEM) and multiscale multi-physics/chemistry computational approach. In this presentation we focused on the computational approach. The use of such a multiscale simulation approach allows studying nanoscale electrochemical deposition as a whole, without the need to assume the formation and growth mechanism such as instantaneous/ progressive or diffusion/kinetic control. The simulation results reveal that the existing theory of nucleation and growth is only valid for some specific conditions. Some of the findings will be discussed in this presentation.

Biography: Dr. Ir. Mesfin Haile MAMME is a joint researcher in Electrochemical and Surface Engineering research group (SURF) and Quantum chemistry group (ALGC) at Vrije Universiteit Brussels, Belgium since May 2014. Mesfin received his B.Sc. in Applied physics from Hawassa (Debub) University in 2006 and M.Sc. in Materials Science from Addis Ababa university in 2013. He was awarded the most prestigious outstanding student Gold medal in 2013, which is only awarded for exceptional achievement. In 2018, Mesfin received his PhD in Engineering Science form Vrije Universiteit Brussel (VUB). His research interest lies in the computational modeling and simulations of nanoscale materials, electrodeposition, battery, fuel cell, supercapacitor, ionic liquid and 2D materials. He has collaborated actively with researchers in several other disciplines of experimental and computational modelling and simulations.

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