Plasma-Assisted Synthesis of Nanolayer Catalysts

The objective of the research is to develop the scientific understanding necessary to use and optimize a successfully developed[16] and already implemented low temperature plasma, Electric Particulate Suspension (EPS),[17] a generated dusty cloud synthesis method to produce, *in a controlled manner*, catalytically active nanolayers[18] of carbides of transition metals, particularly molybdenum carbide,[19] as alternative catalysts for platinum.

The formation of nanolayered structures on the surface of the treated materials differs substantially from the conventional non-thermal plasma assisted processes such as coating and surface modification. It involves complex multiphase transport of reacting species from the plasma volume to the material surface and, then, diffusion and possibly chemical reactions beneath it. The optimization of the process requires tuning of plasma parameters and possibly particulate temperatures to balance the inner and outer fluxes of reacting species.

The developed methods of nanometer scale overlayers preparation on micro- and nanodispersed materials can be further utilized in material synthesis, medicine, electronics and other technological fields. This research will also advance knowledge in plasma particulate processing especially using the EPS technique, as an extension of a prior fluidized bed technique,[20] of forming non agglomerated dust clouds, and will contribute to the fundamental understanding of plasma – material interaction.

The educational and outreach programs are closely incorporated in the proposed research and involve graduate and undergraduate students at the University of Illinois at Chicago, fellow researchers, and high school students and teachers. Participating students will engage in the fields of plasma processing, material characterization, and chemical kinetics.

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