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Gas Phase Production of Nanoparticles down to the Atomic Cluster Range by Spark Ablation

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Spark ablation is a scalable method of producing nanoparticles from a single atom to 20 nm in size. It produces particles of high purity from any conducting or semiconducting material. Compounds like oxides and sulfides can easily be produced by gas reactions downstream of the spark. One of the most interesting features of this method is that production of any mixture of materials is simple. This leads to an unlimited number of possibilities with respect to nanomaterial composition. The mean particle size is adjustable by the ablation parameters. Where a narrow size distribution is required, the particles can be size classified by electrical mobility separation at normal pressure thanks to the electric charge the spark ablation particles carry. Small atomic clusters of a specific number of atoms can be selected that way at normal pressure in a noble gas. 3-D printing of the particles to form (mixed) nanoporous layers offers an enormous flexibility. It has applications in the discovery and production of catalysts, SERS substrates for single molecule detection, chemical sensors and more. Examples will be shown.

References:

[1] Spark Ablation – Building Blocks for Nanotechnology, edited by A. Schmidt-Ott, Jenny Stanford, 2020

CV: Prof. Dr. Andreas SCHMIDT-OTT

Andreas Schmidt-Ott, born in 1952, completed his Ph.D. thesis at the Faculty of Mathematics and Physics of ETH in Zurich, Switzerland in 1979. In 1988 he joined the Faculty of Electrical Engineering at Duisburg University, Germany as Assistant Professor and then became Associate Professor in the Mechanical Engineering Dept. of the same university, where he was Deputy Faculty Chair 1998 - 2001. Subsequently, he accepted a full professorship in Nanoparticle Technology at the Chemical Engineering Department of Delft University of Technology, Netherlands, where he has an emeritus status since 2018.

Since 2016 he is also Adjunct Professor at The Cyprus Institute in Nicosia. His main areas of expertise are Nanoparticle and Materials Technology. He temporarily served as Secretary General of the German Aerosol Association (GAeF) and Board Member of the American Association for Aerosol Research (AAAR). He is or was a member of several Editorial Boards of journals and advisor to the Health Council of The Netherlands. In 2014 he co-founded the company VSPARTICLE (Delft, Netherlands), specialized in solutions for producing and applying particles a few nanometers in diameter, for which he is now working as an advisor.