

Electrophoretic Deposition: Fundamentals and Applications

This special section of the *Journal of Physical Chemistry B* is based on the Fourth International Conference on Electrophoretic Deposition: Fundamentals and Applications (EPD-2011) held in Puerto Vallarta, Mexico, October 2–7, 2011, with further contributions from international researchers involved in the field of electrophoretic deposition (EPD). These triannual EPD conferences, which were first held in 2002, are a leading venue for experts from academia, national laboratories, and industry working on EPD and its applications as a processing technique for fabrication of both traditional and new materials.

Electrophoretic deposition is a technique that exploits the movement of charged particles in suspension in the presence of an appropriate electric field. This electric field enables the consolidation of said particles into films, cast onto any shaped substrate, or into thick, bulk components. To employ electrophoretic deposition successfully, a basic understanding of the colloidal stability, the deposition kinetics, and the constrained drying and sintering issues of the deposit is necessary. Earlier applications of EPD have involved the shaping of ceramics and the production of coatings. Emerging applications of EPD include the low-cost fabrication of composite and nanostructured materials, such as metal-ceramic and polymer nanocomposites, nanocrystalline multilayer structures, composite laminates, biomaterials, and functional gradient materials. Furthermore, EPD of electroceramic materials has been identified as having substantial potential for advancement in a number of applications, like piezoelectric motors, biomedical ultrasound probes, chemical sensors, and multifunctional and/or bioactive coatings. Moreover, EPD has developed into an important instrument in the area of nanotechnology, as the technique enables the production of components of industrial shapes and dimensions from nanoscale constituents, such as nanoparticles, nanotubes, and nanorods. Increasing interest also exists in using EPD to manipulate biomolecules and biological components, including natural polymers, proteins, bacteria, and cells.

The EPD-2011 chairman was Aldo R. Boccaccini, University of Erlangen-Nuremberg, Germany, and the conference co-chairs were Rolf Clasen, University of Saarland, Germany, James H. Dickerson, Vanderbilt University, USA, and Omer van der Biest, Katholieke Universiteit Leuven, Belgium. The meeting continued the conference tradition of high quality contributions of relevance to both industrial and academic participants, involving many of the aforementioned traditional and emergent areas of fundamental scientific, materials processing, and engineering applications research.

The diverse session topics of EPD-2011 included the following: fundamentals of the EPD process and modeling; novel experimental techniques; traditional applications involving ceramics and polymers; traditional applications involving metals and coatings; EPD in industrial applications and technology; novel applications involving composite materials, laminates, nanomaterials, functionally graded materials, materials for solid oxide fuel cells, nanostructured materials, carbon nanotubes, and biomaterials; and EPD of biological entities such as bacteria, cells, and proteins. Even though the topics presented during the conference represented

topics from a broad array of disciplines, common underlying chemical and electrochemical principles, relevant to all of these topics, similar experimental approaches, and shared analytical methods were evident among the lectures and poster presentations. This special section in the *Journal of Physical Chemistry B* captures the major highlights of the key presentations at EPD-2011 and pinpoints the leading research trajectories within the electrophoretic deposition community. Beyond the conference attendees, we have invited prominent researchers involved in different aspects of the fundamentals and applications of EPD worldwide to contribute to this special section of the *Journal of Physical Chemistry B*.

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