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Special Issue in JPD

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Plasma in Liquids for Materials

Plasmas in contact with liquids have been rapidly growing from a niche to a broad processing platform for materials synthesis and modification. Specific examples of systems include a gaseous plasma interacting at a boundary with a liquid surface, a discharge ignited in vapor layers formed at the surface of electrodes immersed in a liquid, or discharges ignited inside a bulk liquid. The unique reactive species contained in the plasma, including ions, electrons, radicals, and UV photons, interact with the liquid, which in turn influences the plasma properties. The combination of plasmas and liquids allows reactions to be performed at low temperatures (near room temperature) and atmospheric pressure. The different phases present a challenge to optimize parameters for specific applications, but also leave room for many interesting fundamental studies. This special issue on plasmas in liquids for materials covers recent progress and advancements related to the synthesis and modification of materials, spanning from fundamentals to applications, from nanoparticles to polymers, and from nanoparticles to coatings. For example, a fundamental study by Forschner *et al* shows how individual short-lived discharges are dynamically formed within a vapor layer during plasma electrolysis, which appears as a glow discharge by visual inspection [1]. The synthesis of nanoparticles is studied by several contributors. Pottkämper and von Keudell use in-liquid plasma to controllably produce metallic copper and copper oxides relevant for the electrochemical reduction of CO₂ to high added value chemicals [2]. Krettek *et al* exploit the high power densities of nanosecond plasmas to create nanoparticles directly from an electrode tip material [3]. Zhu *et al* provide an alternative to chemical synthesis or electrochemical means for Pt nanoparticle preparation on carbon supports, a highly relevant catalyst for the hydrogen evolution reaction, via dielectric barrier discharge [4]. Lasfargues *et al* elaborate on the parameters relevant for producing silver nanoparticles in a solution via sputtering [5]. Finally, Tabarkhoon *et al* [6] investigated coatings, which were produced by polymerization of films on silicone oils using plasma enhanced chemical vapor deposition, and Ajiriyanto and Anawati [7] introduce yttrium oxide nanoparticles by plasma electrolytic oxidation to improve the corrosion resistance of ceramic coatings. We hope you find the collection of papers to be both intellectually stimulating and technology useful. We thank all the contributors and the editorial and publishing staff of J. Phys. D: Appl. Phys., in particular Roisin Guthrie.

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