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Microplasma-liquid interactions for nanomaterials synthesis JENISH PATEL, PAUL MAGUIRE, DAVIDE MARIOTTI, Nanotechnology and Integrated BioEngineering Centre (NIBEC), University of Ulster, Northern Ireland, BT37 0QB, UK — Interactions of microplasmas with solid, liquid and/or gas precursors provide new pathways for the synthesis and surface-engineering of nanomaterials. This study is focused on the plasma-induced non-euqilibrium liquid-chemistry (PiLC) as an effective approach to synthesize colloidal metal nanoparticles without using any reducing/capping agents. Highly dispersed gold and silver nanoparticles (NPs) were synthesized in aqueous solutions without any capping agents which explore the opportunities to functionalize the surface of these surfactant-free metal NPs for a better device applications. In particular, various sizes (5 nm to 100 nm) and shapes (e.g. spherical, hexagonal, pentagonal, triangular, etc.) of the gold nanoparticles (AuNPs) were formed with different concentrations of gold precursor. Moreover, conductivity, pH and temperature of the solutions were measured before and after the plasma processing, in order to realize the basic chemistry initiated by plasma in/at liquid surface. Especially, to understand the basic reduction process of AuNPs synthesis by plasma, we measured the presence the of hydrogen peroxide (H_2O_2) which is believed to be a strong reductant for gold and for the first time we demonstrated experimentally that H_2O_2 is the key factor that reduces the gold precursor to AuNPs. These investigations create the opportunities to understand how these microplasmas can be effectively explored to other materials synthesis/processing.

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