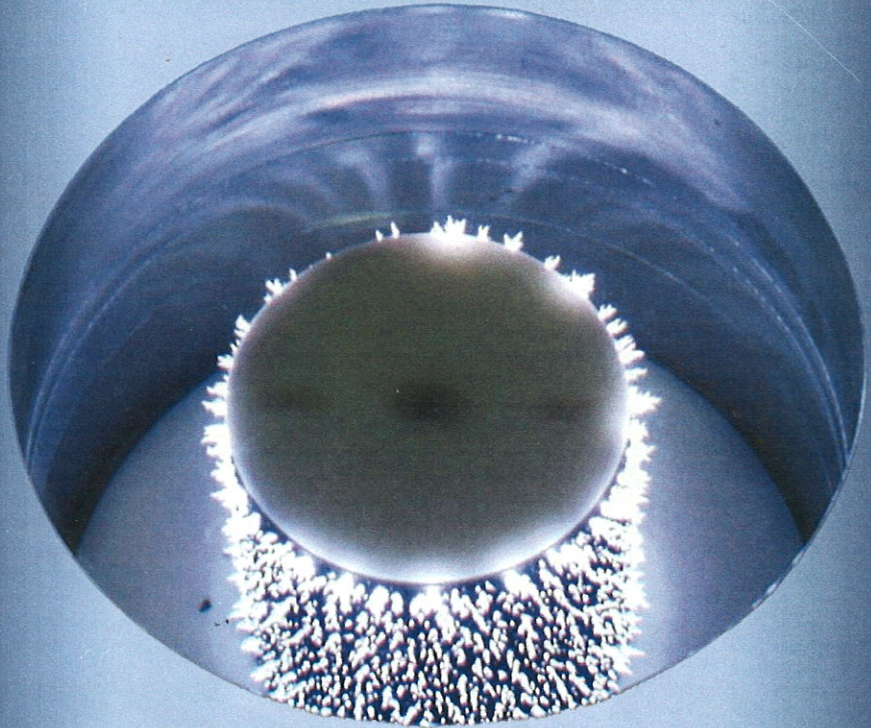


COST Action TD1208

# International Conference on Plasmas with Liquids (ICPL 2017)



## CONFERENCE PROGRAM BOOK OF ABSTRACTS

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## Formation of metallic nanoparticles in air plasma activated water

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Air plasma activated water (PAW) and liquids become recently of the great interest for their bactericidal or therapeutic properties. These are typically given by the synergistic effects of the plasma action and induced chemical changes (via formation of reactive oxygen and nitrogen species). Beside the plasma agents and induced aqueous chemistry, metallic nanoparticles (NPs) sputtered from the electrodes may enhance the chemical effects and contribute to the bactericidal effect of PAW [1-2]. We detected and examined possible NPs in the PAW prepared by the DC-driven transient spark discharge in air in direct contact with water, either in the water spray (WS) or the water electrode (WE) system [3]. In the WS system, the stainless steel hollow needle high voltage electrode enabled the water to be electrosprayed directly through the active zone of discharge. In the WE system, the water was either treated as batch or repetitively circulated on the grounded electrode. The bactericidal action of PAW decays with time and is stronger in the WS system with more NPs detected.

Scanning electron microscopy (SEM) analysis showed morphological changes of the plasma treated needle. SEM observation of the treated DI water showed the presence of particles with the size from nm to several  $\mu\text{m}$ . Detailed analysis of particles by dynamic and static laser light scattering (DLS/SLS) and nanoparticle tracking analysis (NTA) showed a wide distribution of particles mainly below 500 nm (Fig. 1). The electron dispersive X-ray spectroscopy (EDS) analysis confirmed that the elemental composition of the NP was identical with the needle composition (Fe, Cr, Ni, O).

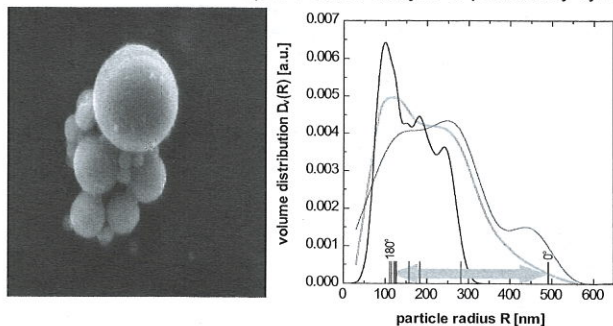


Fig. 1 SEM picture (10,000x magnification) of metallic NPs in PAW (left). Volume size distribution of NP analyzed by various methods (right): black (NTA), green (SLS), blue (optimal combination of NTA and SLS). Vertical lines show DLS data for various scattering angles.

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