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Book of Abstracts

The lines must be inferefernce free, uneffected by other emission lines and should not be self-absorbed, which could contribute to an error. The preselection of the suitable lines of the considered elements and degree of ionization for CF-LIBS analysis is crucially important. The emission lines and their parameters were ontained from the NIST LIBS database[2].

Acknowledgement
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References
[1] M.Duerrschnabel, U. Jantsch, R.l Gaisin , M. Rieth "Microstructural insights into EUROFER97 batch 3 steels"Nuclear Materials and Energy 35 (2023) 101445
[2] A. Kramida, Y. Ralchenko, J. Reader, others, NIST atomic spectra database lines form,"NIST Atomic Spectra Database (ver. 5.2)[Online], 2014. https://physics.nist.gov/PhysRefData/ASD/LIBS/libs-form.html

ID:98# Study of Laser-Induced Plasma Dynamics with Rapid Imaging and Shadowgraphy in an Acoustic Levitation System

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Laser-induced breakdown spectroscopy is a well-known analytical technique with a huge potential for characterization of materials in all three states of matter. It enables quick remote analysis without time-consuming sample preparation. The temporal evolution of plasma in liquid samples due to the nature of liquid itself provides further challenges. Plasma produced by a laser pulse (PPL) in liquid samples, unlike the one in solids, exhibits some difficulties during the plasma formation such as splashing, quenching and plasma duration. For solids, plasma created by laser ablation is generated on the surface of a target. However, in the case of a liquid which is usually transparent to the light source, plasma can be formed on the surface and within the liquid. Hence, the dynamic of the plasma in liquids could change depending on the PPL location.

LIBS on liquids using an acoustic levitation system has recently been reported. This device allows droplets to be suspended in the air to perform analytic determinations with LIBS technique. This approach is called LIBS-AL.

To study droplet dynamics the fast-photo and shadowgraphy techniques were integrated into LIBS-AL setup. Temporal evolution of plasma in liquids was recorded for different focal distances. Both techniques employ a secondary fast camera in addition to an spectrometer, with both cameras simultaneously triggered by the laser. Two separate images were captured: one for the shadow of the levitated sample and another for the ablated plasma. The results indicate variations in the ablated material depending on delay time and focal distance (fluence). Delay times corresponding to the maximum ablated mass were identified.

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ID:111# Rapid Degradation of Coumarin via In Situ Hydroxyl Radical Generation Induced by Recycled Gas from a DBD Plasma

Bubble Reactor

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Coumarin, a fluorescent aromatic compound widely used in dyes, pharmaceuticals, and optical brighteners, is frequently detected in industrial effluents and poses ecological risks due to its persistence, phototoxicity, and potential bioaccumulation in aquatic environments 1. This study presents a novel approach for the rapid degradation of coumarin using recycled gas from a dielectric barrier discharge (DBD) plasma bubble reactor. The DBD plasma device consists of a coaxial geometry (150 mm length, 15 mm outer diameter) with two quartz tubes forming a 1.5 mm discharge gap where plasma is generated. The complete experimental setup is shown in Fig. 1(a). The reactor is immersed in water, allowing reactive oxygen and nitrogen species (RONS) to be transferred into the liquid phase via plasma bubbles, while gas-phase species such as ozone are recycled to a secondary reactor containing the pollutant solution. These recycled oxidants, mainly ozone and hydrogen peroxide, react to generate hydroxyl radicals in situ, accelerating coumarin degradation.

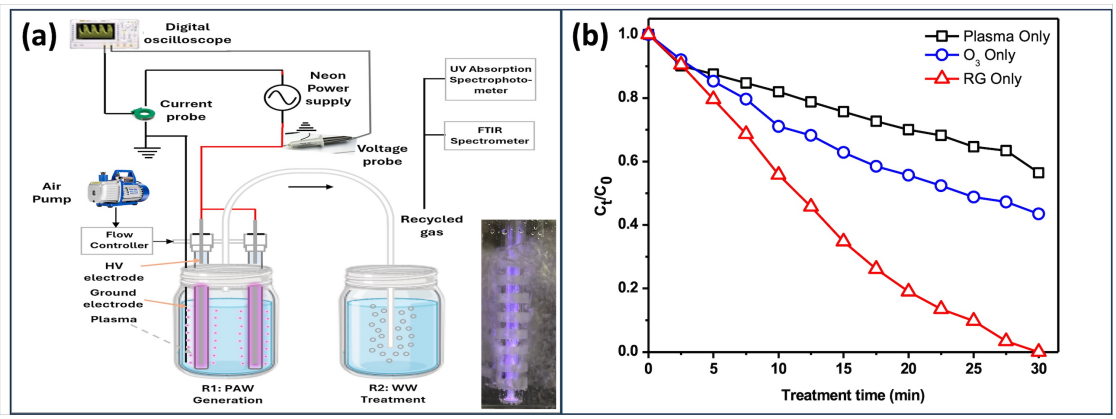

Figure 1: enter image description here

Fig. 1. (a) Complete experimental setup for coumarin degradation, (b) Degradation profile of coumarin under three different treatment conditions.

The performance was evaluated under three conditions: (i) plasma bubbling, (ii) recycled gas treatment, and (iii) ozonation alone. Hydroxyl radicals were quantified in all cases using a terephthalic acid fluorescence probe, revealing that the secondary reactor with recycled gas diffusion produced the highest radical concentration, correlating with the maximum degradation. Among these, the recycled gas system achieved 99% degradation within 25 minutes, demonstrating superior efficiency, as shown in Fig 1(b). The presence of excess nitrogen species in the primary plasma zone reduced degradation efficiency compared to ozone alone, emphasizing the role of optimized gas recycling in enhancing plasma-based oxidation.

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1. Aspatwar A, Berrino E, Bua S, Carta F, Capasso C, Parkkila S, Supuran CT. Toxicity evaluation of sulfamides and coumarins that efficiently inhibit human carbonic anhydrases. J Enzyme Inhib Med Chem. 2020 Dec;35(1):1765-1772. doi: 10.1080/14756366.2020.1822829.

ID:112# Detection of Indoor Ketones Using Ion Mobility Spectrometry with Air as Carrier Gas