Dynamics of laser ablation in liquid with confined target geometry

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Pulsed laser ablation in liquid (PLAL) is a sustainable and swift approach of synthesizing nanoparticles (NPs) and nanocomposites. In this method, a high energy pulsed laser beam is focused on a target (mostly metallic in nature) which is submerged in a transparent liquid such as distilled water (DW). Due to high photon density, various dynamic processes occur at the solid-liquid interface such as plasma formation, shockwave emission, cavitation bubble oscillations, and eventually, the formation of NPs which are dispersed in the liquid and form nano-colloid solution [1,2]. Due to close correlation between NPs and the dynamics of laser ablation, laser parameters such as laser wavelength, pulse duration, laser fluence, and external fields play a crucial role in determining the properties of NPs [1]. Target geometry also affects the properties of NPs, such as its size, morphology, and optical properties. Different morphologies of target such as wire-shaped target have been studied and it has been found to increase the efficiency of laser ablation. In the present study, cavitation bubble dynamics of PLAL, conducted in a confined space is studied using shadowgraphy. A channel is fabricated at the center of the metal target and the laser is incident inside the channel. The walls of this channel, or a valley, will constrict the laser produced plasma and affect the dynamics, and hence the NPs. Different widths (2 mm, 3 mm, 4 mm) of this valley have been studied so that the effect of enhanced confinement of laser ablation spot can be studied. Temporal evolution of cavitation bubble size, pressure and temperature as well as the effect of confinement on NPs will be presented in the conference.

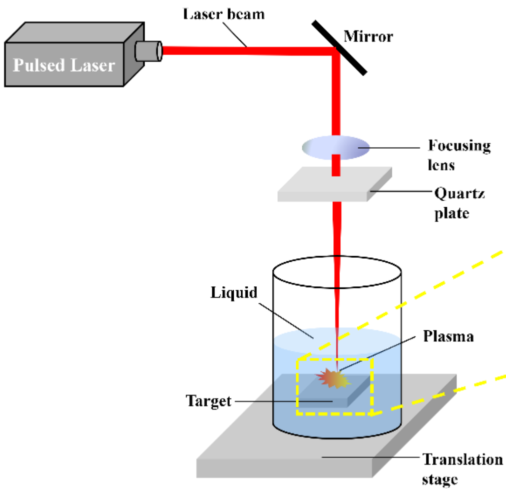

Figure 1 Schematic of experimental setup for valley ablation. the cross-sectional view of valley ablation target is shown (inset).

References

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