

Seminar

Institute for Plasma Research

Title : Underwater Electrical Wire Explosion

Speaker: Dr. Somesh Tewari

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Date : 20th September 2018 (Thursday)

Time : 3.30 PM

Venue : Committee Room 3, (New Building), IPR

Abstract :

Underwater electrical wire explosion studies can be used for validation of equation of state and conductivity models [1]. Several methods which include power lasers, Z-pinch, high energy ion beams are used to bring materials to extreme conditions characterized by temperature $>10^4$ K and pressures $>10^{10}$ Pa. However most of the above methods require energy in the MJ range. Underwater electrical wire explosion of wires using pulse power systems is utilized for this purpose with only several kJ of stored energy. Large energy density can be deposited into the wire material due to small compressibility of water which prevents fast radial expansion and large breakdown field in water avoids arcing. Spherical wire explosion studies are carried out to increase the pressure, density, temperature in the vicinity of the converging shockwave. Presented research work is an attempt to increase pressure, density and temperature of the fluid near the converging shockwave center by increasing the energy delivered to the fluid, varying the spherical array diameter (20-30mm) as well as use of different shockwave medium (water and glycerol). Glycerol is chosen as different medium because of high Ohmic resistivity, transparency to visible light, possible combustion[2]. Further a comparison study of spherical wire explosion in glycerol and water is carried out on microsecond and sub-microsecond time scale and it is concluded that in order to increase the shockwave velocity it is required to increase the initially stored energy rather than increasing the energy deposition rate[3].

References-

1. "Underwater Electrical Explosion of Wires and Wire Arrays and Generation of Converging Shock Waves" Yakov E. Krasik, Sergei Efimov, Daniel Sheftman, Alexander Fedotov-Gefen, Oleg Antonov, Daniel Shafer, David Yanuka, Michael Nitishinskiy, Maxim Kozlov, Leonid Gilburd, Gregory Toker, Svetlana Gleizer, Eran Zvulun, Victor Tz. Gurovich, Dmitry Varentsov, and Maria Rodionova IEEE Transactions on Plasma Science, Vol. 44, 412-430, April 2016
 2. "Spherical wire arrays electrical explosion in water and glycerol" Alexander Rososhek, Sergey Efimov, Mikhail Nitishinskiy, David Yanuka, Somesh Vinayak Tewari, Victor Gurovich, Konstantin Khishchenko, Yakov Krasik, Physics of Plasmas, Vol. 24, 122705, December 2017
 3. "Comparison of underwater electrical explosions of spherical wire arrays at different timescales" A. Rososhek, S. Efimov, Somesh Vinayak Tewari, D. Yanuka, V. Tz. Gurovich, and Ya. E. Krasik Physics of Plasmas Vol. 25, 062709, June 2018
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