

## Experimental study of single exploding wire behavior in air and vacuum

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Electrically Exploding Wires (EEW) is one of way to achieve Z-pinches. High energy density plasmas of Z-pinches are useful for Inertial Confinement Fusion studies. Single wire explosion study [1] can help in understanding the dynamics of energy deposition and physics involved in phase explosion of wire. These studies have relevance in understanding implosion of wire arrays like cylindrical wire arrays, conical wire arrays, X-pinches etc.

Experiments have been carried out for studying the behaviour of single exploding wire in air and vacuum for variable diameters. Voltage and current characteristics have been observed. Capacitor bank of 2 $\mu$ F has been used to explode 3.4 cm long copper wire at 16 kV charging voltage. Diameters of 58  $\mu$ m, 81  $\mu$ m, 233  $\mu$ m and 400  $\mu$ m have been taken. Shots have been taken separately in air and vacuum for each diameter. Each shot has been repeated three times. Output voltage across load has been found to increase with decreasing diameter in vacuum. There is an optimum diameter for maximum output voltage in air and vacuum [2] both. However, we have not observed this optimisation in vacuum with our experimental parameters. It is possible that optimised diameter lies at diameter lower than minimum diameter (58 micron) taken in our experiments. In case of air, optimum diameter has been found at 81 micron for which output voltage was maximum in air. This implies that more current density is required for same energy deposition in vacuum than air. It has also been noticed that there are no dwell periods and re-striking in shots taken in vacuum. Duration of dwell period and re-striking in single wire explosion in air depend upon diameter. Work is underway to analyse the mechanisms involved.

### References:

- [1] Experimental analysis of energy deposition in single exploding wire of various diameters and capacitor bank energies, 30<sup>th</sup> National Symposium on Plasma Science & Technology, India, 181 (PLASMA 2015).
- [2] Effect of wire parameters on the emission of hard z-rays from exploding wires, Journal of Applied Physics, **42**, **5**, 1876 (1971).