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SPECTROSCOPIC DIAGNOSTICS OF HIGH CURRENT DENSITY EXPLODING COPPER WIRE PLASMA ATSTANDARD AMBIENT TEMPERATURE PRESSURE

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ABSTRACT

Optical emission spectroscopy was applied to study electron temperature and electron number densityof plasma generated during exploding copper wires. Neutral spectral lines dominated spectrum in visible range which are used for determination of electron temperature and electron number density. Transitions $3d^9 4s(^3D)5s^2D_{3/2} \rightarrow 3d^9(^2D)4s4p(^3P^0)^2F^0_{5/2}$ at 464.25 nm, $3d^{10}4p^2P^0_{3/2} \rightarrow 3d^9 4s^2D_{5/2}$ at 510.55 nm, $3d^{10}4d^2D_{3/2} \rightarrow 3d^{10}4p^2P^0_{1/2}$ at 515.32 nm, $3d^{10}4d^2D_{5/2} \rightarrow 3d^{10}4p^2P^0_{3/2}$ at 521.82 nm and $3d^{10}4p^2P^0_{3/2} \rightarrow 3d^9 4s^{22}D_{3/2}$ at 570.02 nm are used for determination of electron temperature using Boltzmann plot method. Electron number density is determined by using Stark broadened 521.82 nm Cu I line. Electron temperature and electron number density is found to be in range 9200 K to 18200 K and $3.02x10^{16}$ cm^{-3} to $6.91x10^{16}$ cm^{-3}. Variation of electron temperature and electron number density is studied as function of wire cross section area and discharge energy. Plasma parameters are observed to vary directly with discharge energy and inversely with cross section are of wire being exploded. Validity of assumption of local thermodynamic equilibrium is also discussed.

KEYWORDS: Electron Temperature, Electron Number & Local Thmerodynamic Equilibrium

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Original Article