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Time-resolved measurement of pressure evolution in underwater nanosecond discharge ILYA MARINOV, OLIVIER GUAITELLA, SVETLANA STARIKOVSKAIA, ANTOINE ROUSSEAU, LPP, Ecole Polytechnique, COLD PLASMA TEAM — Electrical discharges in water and other dielectric liquids have been extensively studied since almost fifty years, however reliable data on plasma parameters within the propagation phase is still missing. We report on shadowgraphic imaging and optical emission spectroscopy (OES) both with nanosecond time resolution of pulsed nanosecond discharge generated with point to wire electrode configuration. High voltage pulses of 10 kV and 30 ns duration (FWHM) are delivered by commercial pulse generator FPG 10 (FIG GmbH). Sub-millimeter discharge with filamentary structure develops at 50 km/s in axial direction of pin electrode. Using Hugoniot equations maximal discharge pressure at ignition can be obtained from shock wave front velocity. Analytical model of supersonic cavity expansion based on Kirkwood-Bethe approximation gives discharge pressure evolution from experimentally measured discharge channel expansion velocity profile. Thus, the pressure of 5 GPa is measured at the discharge ignition and drops drastically by the end of voltage pulse. Time-resolved OES spectrum shows a strong broadening of atomic Hydrogen (Balmer series) and oxygen (OI 777 nm) lines with almost continuum emission in the region 300-700 nm. Complex Hα and OI 777 profiles are due to combined contribution of Van Der Waals and Stark broadening. Electronic density can be deduced from lorentzian fit of Stark broadening and gives for electronic density $10^{24} - 10^{25}$ m^{-3}.

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