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Pulsed plasma discharge in liquids at ultra-high pressures JACOB MALLAMS, Texas AM University, XIN TANG, MIRZA AKHTER, DR. DAVID STAACK, Texas A/M University, JACOB MALLAMS 1, MIRZA AKHTER 1, XIN TANG 1, DAVID STAACK 1* TEAM[1] — Plasmas are used regularly in applications found within geosciences, sanitation, and more. These techniques may also have applications within high pressure fluids. One of these applications is rock drilling where downhole pressures can reach up to 10000 psi. In order to observe the effect of plasma in these conditions, plasma have been studied within fluid in the range of 14.7 psi to 5000 psi. This study investigates potential changes in mechanisms and effects of plasma breakdown in liquids of this factor 300 variation in initial pressure. To achieve said pressures, a pressure vessel was created using pipe fittings available off the shelf, a high pressure pump, viewing glasses, electrical feedthrough, and a 3D printed testing fixture. Plasma discharges have been studied at a variety of voltages ranging from 5kV to 15kV across a 1-3 mm spark gap. 80J, nanosecond pulsed plasma discharges were carried out at different pressures. Testing was recorded with a high speed camera and electrical diagnostics in order to fully identify the breakdown, plasma discharge, and induced bubble activity within the vessel. Preliminary tests show that plasma creation at high pressures is possible but that it requires an increasingly small gap to create breakdown. It is expected that these tests will provide insight to the feasibility of plasma use in other extreme environments.

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