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1P46 - Numerical simulation of a spark channel expansion in water and its comparison with an experimental result

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The main difficulties in verification of numerous mathematical models of an electrical discharge in water is a lack of experimental studies observing a spark channel expansion and its comparison with an experimental result. As a rule, the authors compare an acoustical signature produced by an underwater discharge and also how a bubble cavitation matches the simulation. The presented investigation numerically studies an incompressible approach for a spark expansion and compare it to experimental results obtained by a high speed camera and optical hydrophone. An electrical energy delivered to a plasma channel through Joule heating is divided between an internal energy of the plasma–vapor mixture inside the channel and a mechanical work done by an expanding channel. The total energy deposition is described by an energy balance equation [1]. The pressure in liquid on a spark wall p(t) is described using two mathematical expressions for the pressure p(t) proposed by Naugolnych / Roy [1] and Braginskki [2]. The temporal variations of a spark channel radius, its velocity and pressure wave generated by an expanding spark have been obtained and compared with the experiment. The spark expansion process is perfectly predicted by incompressible approach when the input energy is less than 16 J and can be used for practical applications under this limit.

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References

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