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A MULTILAYER STRUCTURE OF COMPRESSED WATER FLOW GENERATED BY RE-STRIKE IN UNDERWATER ELECTRICAL WIRE EXPLOSION

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Underwater electrical wire explosion (UEWE) has attracted the attention of researchers in the field of warm dense matter physics and applied physics in the past several decades. Current pause is a common phenomenon in UEWE, however, the physical process of the re-strike in UEWE is still not very clear till now due to the difficulty of direct diagnostics, so is the formation mechanism of the re-strike shock wave. In this work, a "multilayer structure"of the compressed water flow generated by re-strike in underwater electrical explosion of Cu wire was reported, and corresponding experimental and numerical researches were carried out. It is believed that the partial heating of the re-strike arc initiate a pressure wave that propagates back and forth inside the wire, resulting in the oscillating of pressure on the wire boundary and consequently resulting in an oscillating radial density distribution of the compressed water flow generated by re-strike. This special compressed water flow leads to a "multilayer"structure in the shadow images and schlieren images. The simulation results of a one-dimensional hydrodynamic model supported the above explanations, and indicated that the radius of re-strike arc was about 0.3 times of that of the expanding wire. As the re-strike energy deposition rate increased with the charging voltage, this kind of compressed water flow with oscillated density distribution evolved into one single shock wave finally.

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