Microsecond pulse discharge in oil: electrohydraulic effect, gas generation and mechanics

Hang Wang, Tao Shao
Beijing International S&T Cooperation Base for Plasma Science and Energy Conversion, Institute of Electrical Engineering, Chinese Academy of Sciences, Beijing 100190, China
e-mail: wh@mail.iee.ac.cn
Type: Plenary talk
Abstract: The mechanics of microsecond pulsed discharge in oil is the foundation for understanding the discharge process in liquid. physical process. In this work, the shock wave and bubble generated by microsecond pulsed discharge in oil between needle-needle electrodes are studied by a Schlieren system with a high-speed camera. Besides, the shock wave and bubble are simulated by OpenFOAM. Gas production characteristics are measured by GC-MS and flow meter. Moreover, the reaction pathways of oil are deduced by molecular dynamics and plasma kinetic simulation. The results show that the first shock wave is generated by rapid heating of plasma in oil, and the second shock wave is resulted from the density rapid change when the bubble collapses. The gas in the bubble is mainly composed of H_2 and C_2H_2 generated by oil decomposition under plasma. The main decomposition pathway of oil is long hydrocarbon chains to short chains and C_2 production, then the main intermediate gas product C_2H_4 decomposes to C_2H_2 and H_2.