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Plasmas in High-Density Medium - Supercritical fluid plasma and Cryogenic plasma[1]

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Recently, there has been a lot of attention to plasmas in high-density medium as novel plasmas from the views points of not only pure sciences but also various technologies. In this talk, two topics, supercritical fluid plasma and cryogenic plasma, will be discussed. First, plasmas generated in supercritical fluids (supercritical fluid plasma) provide a new reaction field that combines the high reactivity of plasmas with the unique characteristics of supercritical fluids, i.e. molecular clustering and density fluctuations near the critical point. An overview of the earliest studies on plasmas generated in supercritical fluids to recent advances in the field, including synthesis of novel nanomaterials such as highly-order diamondoid (diamond molecules), will be given. Second, continuing to thermal plasma (gas temperature Tg higher than a few thousands to millions of K) and low temperature plasma (Tg ranging from a few hundreds to thousands of K), plasma in a third range of gas temperatures (Tg lower than 300 K) is called cryogenic plasma (or cryoplasma) to distinguish it from thermal and low-temperature plasmas. In our group, the gas temperature of the plasma can be continuously controlled below room temperature (RT) down to a cryogenic temperature such as the boiling point of helium (4 K). In addition to the diagnostics, the application of cryogenic plasma to nanoporous material processing (low damage ashing of low-k materials) will be discussed.

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