GEC17-2017-000034

Abstract for an Invited Paper
for the GEC17 Meeting of
the American Physical Society

Numerical Investigation of Interactions between Reactive Oxygen Species and Biological Membrane in Atmospheric Nonequilibrium Plasma with Molecular Dynamics

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Recently, direct contact processes of plasma species with various substances such as liquids and biomaterials have been established using stable nonequilibrium plasma under atmospheric pressure. The advanced plasma technology has been applied to industrial treatments. In particular, plasma medicine is one of the most attractive applications. However, various interactions among multiphase interfaces are extremely complicated. Theoretical modeling and numerical simulation are essential for understanding of the above mechanism. For multiphase behaviors among plasma, gas, liquid and biological objects, the numerical simulations using molecular dynamics are suitable because of the simplicity on physical mechanics. In the present work, fundamental modeling of multiphase including plasma, gas, liquid and biological objects under atmospheric pressure is introduced, and typical procedures of molecular dynamics are briefly described. Some analytical examples of plasma - biological interface are reviewed in the latest topical applications. The chemical reactions between reactive oxygen species and biomolecule are described with respect to the temporal energy balance. The transport characteristics of reactive oxygen species in biological membrane are also discussed.