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Characteristics of Molecular Band Energy Structure of Lipid Oxidized Mammalian Red Blood Cell Membrane by Air-based Atmospheric Pressure Dielectric Barrier Discharge Plasma Treatment

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Lipid peroxidation induces functional deterioration of cell membrane and induces cell death in extreme cases. These phenomena are known to be related generally to the change of physical properties of lipid membrane such as decreased lipid order or increased water penetration. Even though the electric property of lipid membrane is important, there has been no report about the change of electric properties after lipid peroxidation. Herein, we demonstrate the molecular energy band change in red blood cell membrane through peroxidation by air-based atmospheric pressure DBD plasma treatment. Ion-induced secondary electron emission coefficient (γ value) was measured by using home-made gamma-focused ion beam (γ -FIB) system and electron energy band was calculated based on the quantum mechanical Auger neutralization theory. The oxidized lipids showed higher gamma values and lower electron work functions, which implies the change of surface charging or electrical conductance. This result suggests that modified electrical properties should play a role in cell signaling under oxidative stress.

Keywords: Lipid peroxidation, DBD plasma, gamma-focused ion beam

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Chamber Monitoring with Residual Gas Analysis with Self-Plasma Optical Emission Spectroscopy

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Plasma processing is an essential process for pattern etching and thin film deposition in nanoscale semiconductor device fabrication. It is necessary to maintain plasma chamber in steady-state in production. In this study, we determined plasma chamber state with residual gas analysis with self-plasma optical emission spectroscopy. Residual gas monitoring of fluorocarbon plasma etching chamber was performed with self-plasma optical emission spectroscopy (SPOES) and various chemical elements was identified with a SPOES system which is composed of small inductive coupled plasma chamber for glow discharge and optical emission spectroscopy monitoring system for measuring optical emission. This work demonstrates that chamber state can be monitored with SPOES and this technique can potentially help maintenance in production lines.

Keywords: Self-plasma optical emission spectroscopy (SPOES), Plasma, Diagnosis, Chamber Monitoring