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Cooling Energy Distribution of Secondary Ions at the Travelling-wave Ion Guide by Helium and Molecular Nitrogen

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The Ar-cluster ion source at energy in order of keV was installed with the Q-ToF (Quadrupole Time-of-Flight) premier at the Quantum Science and Engineering Center, Kyoto University. The main component of Q-ToF premier consists of the travelling-wave ion guide, mass filter quadrupole lens, travelling-wave collision cell, and time of flight analyzer. The 1,2-Distearoyl-sn-glycero-3-phosphocholine (DSPC) sample was used to analyze the cooling energy distribution at the travelling-wave ion guide by helium and molecular nitrogen. The DSPC sample was impinged with primary Ar-cluster ions at energy 10 keV and sputtered with secondary ions in energy range from zero to several hundred eV. Sputtered or secondary ions were extracted to the Q-ToF mass spectrometer. The experiment was designed to measure the DSPC mass spectrum in two modes at varied pressures of helium and molecular nitrogen. The first mode was MS mode and the other was MSMS mode which defined the m/z = 790.6 Da, molecular protonated, at the mass filter quadrupole lens. The experiment found that the secondary ion yield (SIY) of the MS mode reached the maximum at 2.0 and 0.4 Pa for helium and molecular nitrogen, respectively. At the MSMS mode, the SIY reached the maximum at 2.5 and 0.4 for helium and molecular nitrogen, respectively. However, in the MSMS mode, some fragments could not be eliminated by the cooling molecular nitrogen. The helium cooling energy distribution and the transverse direction of secondary ions were more effective and stable than molecular nitrogen.

Keywords: Ar-cluster ion source, Q-ToF, 1,2-Distearoyl-sn-glycero-3-phosphocholine (DSPC), MS mode, MSMS mode.

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