Advanced research for optimizing the performance of an LEF-TOF ion energy mass analyzer

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Ground-based observations have discovered that the Moon has tenuous alkali-atmosphere. The production of this rarefied atmosphere is related to several specific physical processes. Sputtering by the solar wind and desorption by the solar UV are thought to be the two major production mechanisms. Through such physical processes, ions are also generated and they are picked up and transported by the solar wind.

IMA (Ion Mass Analyzer) on board the SELENE satellite will measure these picked-up ions around the Moon. IMA adopts foil-based LEF (Linear Electric Field) TOF (Time Of Flight) technique for mass analysis in order to discriminate heavy ions up to mass number 60. Thin carbon-foils are placed the entrance part of IMA in order to generate start electrons when ions enter the analyzer. If incident ions exit the carbon foil as positive ions have the smaller kinetic energy than the reflection potential, they are reflected by the LEF. When reflected ions impact the top part of the analyzer, secondary electrons are emitted, and they are detected as the stop signals. The advantage of LEF TOF method is that, the flight time of reflected positive ions is not affected by the energy degradation nor angular scattering caused by the carbon foil.

MgO-coated copper beryllium plate is installed at the upper part of the analyzer to generate stop electrons efficiently. Though we have empirically found that stop electron generation is enhanced by MgO-coated copper beryllium plate, the quantitative analysis for the efficiency is insufficient. We will compare the efficiency between different electron emitter plates and try to find the necessary condition for optimizing electron emission.