Time of Flight Secondary Ion Mass Spectrometry of the Košice meteorite – technique and results

Justína Nováková, Monika Jerigová, Dušan Velič

We report the analysis of two Košice meteorite fragments (77/1 and 77/2) with the Time of Flight Secondary Ion Mass Spectrometry (ToF SIMS) technique.

The ToF SIMS is a qualitative, non-destructive surface analysis based on bombarding the sample with a primary ion beam, leading to collision cascades and emission of secondary ions from the analysed surface. Secondary ion masses are discriminated in the Time of Flight detector. We used a Bi primary ion beam with a 1 pA current, extraction field was set to 2000 V. Resulting mass resolution was 7000 for most elements. Secondary ion spectra were obtained in both positive and negative polarity.

Our preliminary results are in good agreement with the previous analysis of other fragments of the Košice meteorite published by [Ozdín et al., 2015] ICP-MS and whole-rock analysis, and CF-LIBS by [Horňáčková, Plavčan et al., 2014]. We found all the major (Mg, Si, Fe) and minor elements (Na, Al, Ca, Cr, Mn, Ni) reported by [Horňáčková, Plavčan et al., 2014] as well as some other elements (P, S, Cl, K, Sc, Ti, V, Mn, Co, Cu, Ga, Rb) reported by [Ozdín et al., 2015].

The main asset of ToF SIMS analysis lies in its capability to distinguish element isotopes. This enables us to determine isotope ratios and therefore separate terrestrial samples from actual meteorites. In Košice meteorite fragments, isotopes of Li, B, Mg, Si, Ca, Ti and Fe were identified. As of now we do not acquire yields sufficient for an accurate calculation of their isotope ratios. Obtaining larger data statistic should be enough to improve the accuracy.

References

[Ozdín et al, 2015] Ozdín, D. (2015). Mineralogy, petrography, geochemistry, and classification of the Košice meteorite. Meteoritics & Planetary Science, 50: pages 864-879.

[Horňáčková, Plavčan et al., 2014] Horňáčková, M., Plavčan, J. (2014). Calibration-free laser induced breakdown spectroscopy as an alternative method for found meteorite fragments analysis. The European Physical Journal, Applied Physics, 66 (1).