Stigmatic isotope imaging of solar system materials using cryogenic LG-SIMS

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Imaging is a valuable tool for human perception of the external world. Recent fluorescence imaging systems employ specialized stigmatic lenses and gigapixel imagers to facilitate simultaneous observation of the entire brain at the cellular level [1].

Stigmatic SIMS instruments continue to provide novel insights into Earth and planetary science [e.g. 2,3], despite the fact that their spatial resolution has remained unchanged for approximately half a century [4]. In the context of the semiconductor field, where the required sensitivity and spatial resolution are approaching their physical limits, stigmatic methods have the potential to enhance sensitivity by collecting signals from a large number of identical structures.

Cryogenic stages have been developed since the advent of SIMS with the objective of reducing the volatilization of wet materials in vacuum [e.g. 5]. The analysis of frozen samples by SIMS presents a number of challenges, including the smooth surface treatment or the introduction into the instrument without frosting while maintaining a low temperature. By overcoming these difficulties, SIMS can become a more beneficial technique not simply for biological samples that need to be prevented from evaporating in a vacuum, but also for experimental samples under extreme high temperature and pressure conditions, such as the Earth's core, where redistribution of elements due to depressurization must be prevented.

We will present the results of our analysis of solar system materials using stigmatic imaging and cryogenic techniques with LG-SIMS.

References

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