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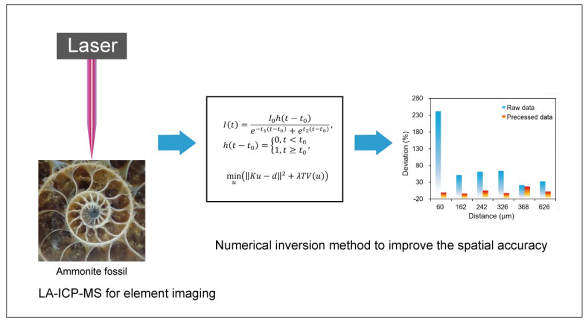

A new numerical inversion method to improve the spatial accuracy of elemental imaging for LA-ICP-MS

YUAN HU, ZHAOCHU HU AND WEN ZHANG
China University of Geosciences (Wuhan)

LA-ICP-MS enables elemental imaging by raster scanning the sample surface with a laser beam, providing trace sensitivity and high spatial resolution for multi-element mapping.[5, 6] However, the accurate determination of spatial information is constrained by the decoupling between elemental distribution and mass spectrometry signals. This decoupling results from two independent processes that distort spatial information and blur phase boundaries.[4] This study investigates both processes in detail and proposes approaches to reduce their impact.

Reconstruction of elemental distribution using mathematical algorithms is an effective approach to address the decoupling of mass spectrometric elemental data and the realistic spatial information.[1-3] In this study, we establish a comprehensive numerical inversion method targeting the independent events of aerosol diffusion and overlapping ablation in LA-ICP-MS. A new signal fitting model and deconvolution algorithm are employed to mitigate the effects of aerosol diffusion. Additionally, boundary identification and restoration algorithms are developed to resolve the challenges posed by blurring of the phase boundary when the laser beam scans over the two-phase interface. [4]

The proposed method demonstrates good performance in calculating phase morphology, achieving an accuracy better than 10%, and outperform traditional line scanning signal processing models. Elemental images processed with this method exhibit clearer boundaries, providing more accurate spatial information.

References

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