

# SIMS Analysis of an Oxide Thin Film with Continuous Composition Gradient

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## Isotopic & Elemental Analysis

### Context

- Analysis of  $\text{Ba}_{1-x}\text{Sr}_x\text{TiO}_3$  thin films with a continuous composition gradient, used to study elemental distribution and depth profiling via SIMS. Prepared by combinatorial pulsed laser deposition (PLD), this setup allows a thorough examination of matrix effects and compositional dependency on physical properties.

### Methodology

- D-SIMS to investigate isotopic and elemental gradients in a thin film (~250 nm), leveraging PLD to create a graded composition of Ba and Sr along the film width.
- Procedures to handle mass interferences, including simulations, were implemented to identify complex overlapping signals due to the sample's heterogeneity



## Advantages of D-SIMS in Thin Film Analysis

### Depth profiling

- Achieves ~5 nm of resolution, crucial for studying sharp interfaces in complex oxide structures

### Matrix effect insights

- Ti signal varies with Ba and Sr composition, indicating influence from electronegativity changes due to Ba-to-Sr substitution

### Sharp interfaces

- Analyzed interfaces (e.g.,  $\text{La}_{0.9}\text{Sr}_{1.1}\text{NiO}_4$  /  $\text{SrTiO}_3$ ) show minimal inter-diffusion, validating SIMS for interface studies



## Key Findings & Further Studies

### Depth resolution

- Atomic mixing broadens interface profiles by approximately 5 nm, verified with atomic force microscopy and electron dispersive spectroscopy

### Potential applications

- The approach extends to other oxides and materials requiring precise depth resolution, like superconducting nickelates and oxygen-sensitive films

### Further studies

- Suggested exploration of matrix effects linked to electronegativity and oxygen stoichiometry variations in oxide films



### QUICK TIPS

## For high performance D-SIMS Characterization

- **Maximize Sensitivity:** Use high primary ion density and automated mapping for better isotope detection.
- **Adjust Resolution:** Fine-tune mass resolution to minimize isobaric interferences and improve reproducibility.

Watch the webinar:

[CLICK HERE](#)

Or scan the QR code

