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# XRR-GIXRF combined characterization of Mg/Sc multilayer

Hina Verma<sup>1</sup>, Karine Le Guen<sup>1</sup>, Yves Ménesguen<sup>2</sup>, Renaud Delaunay<sup>1</sup>, Marie-Christine Lépy<sup>2</sup>, Philippe Jonnard<sup>1</sup>

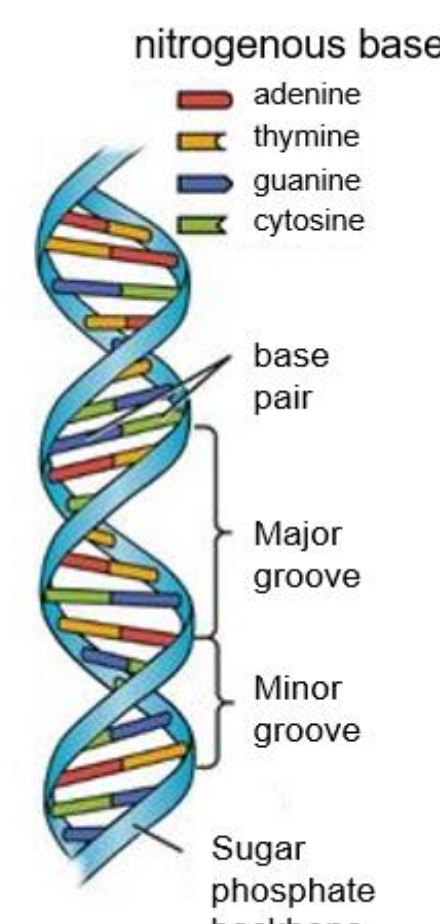
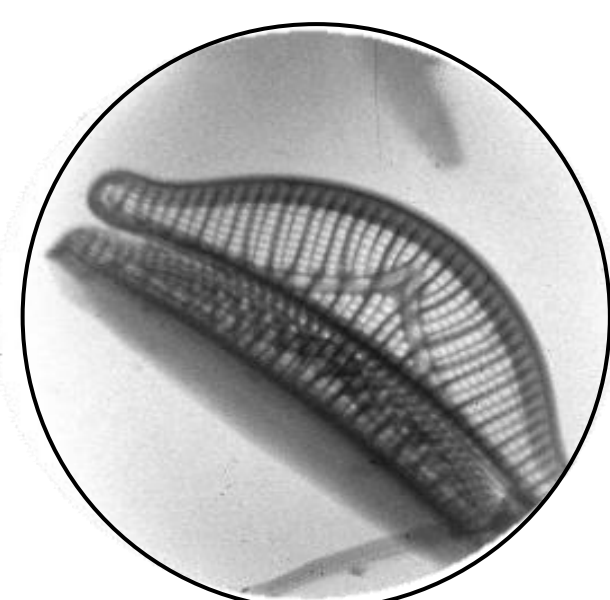
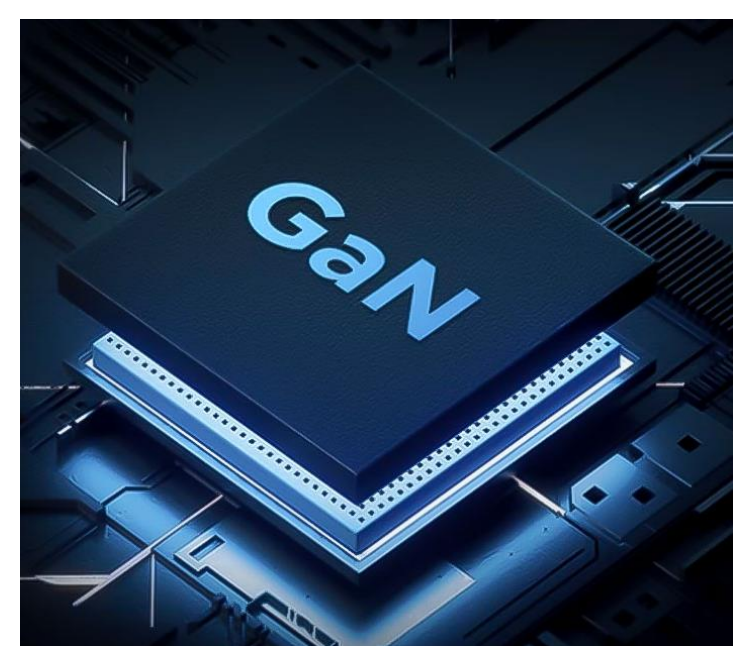
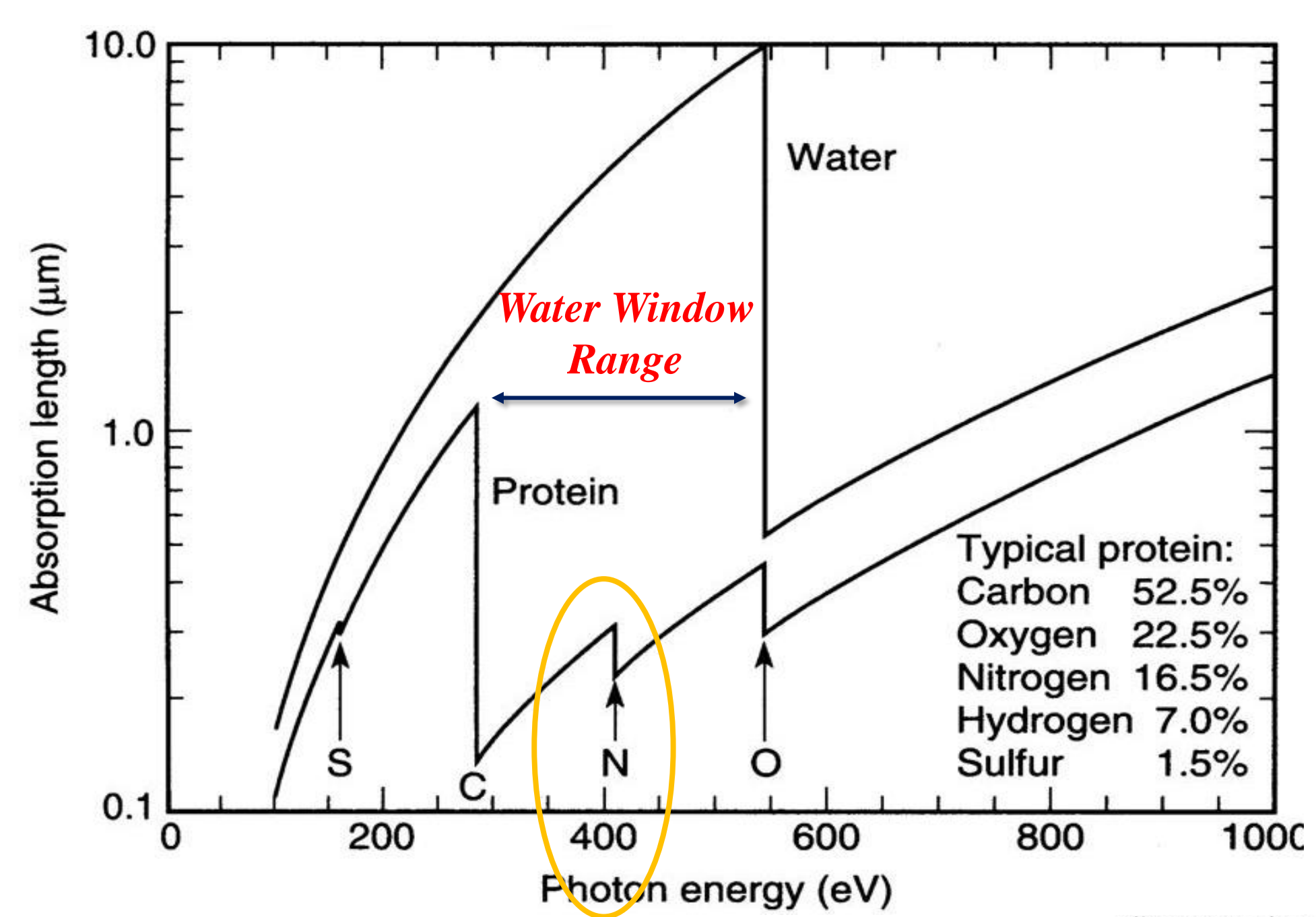
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## Motivation

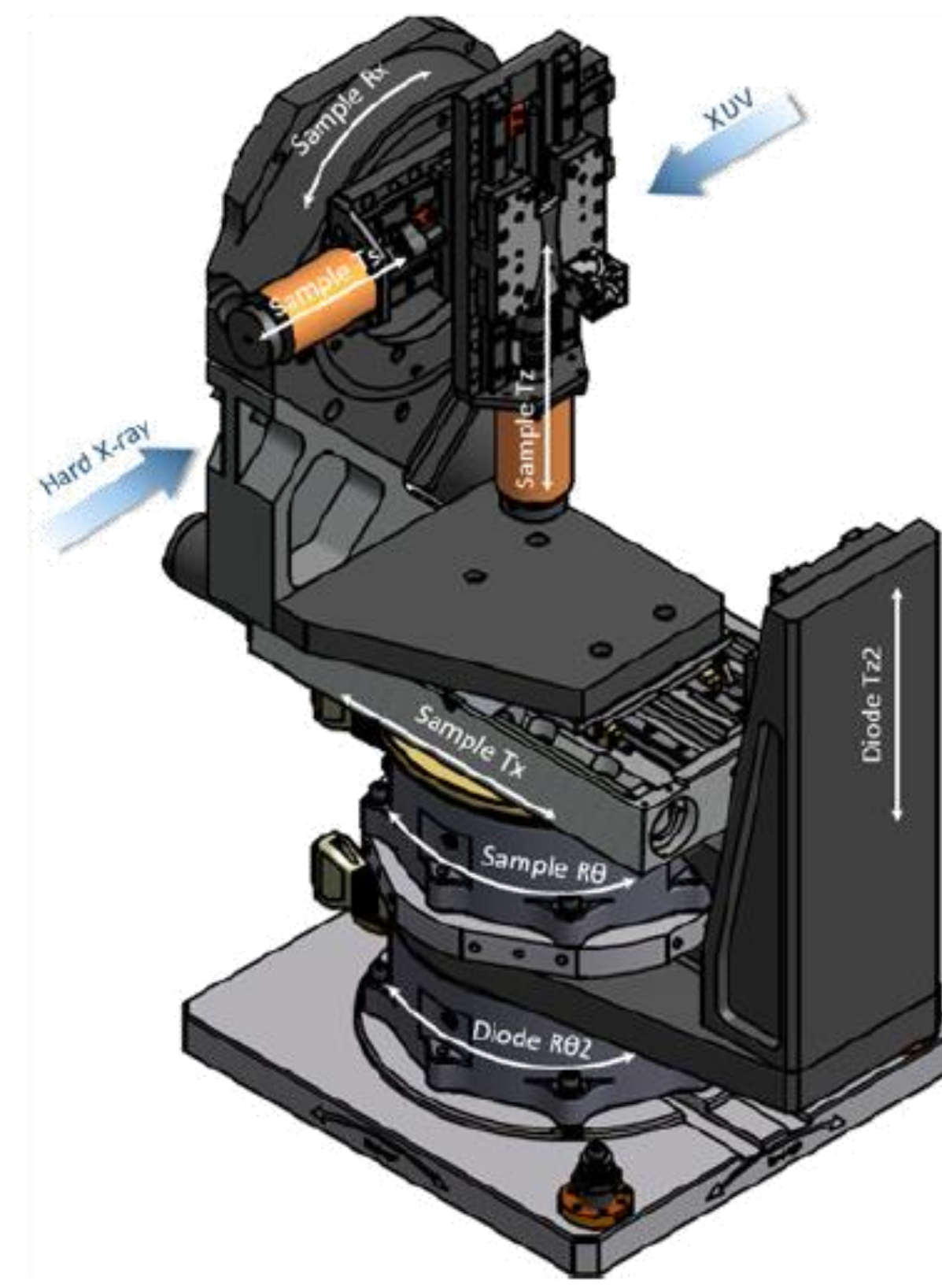
Design of multilayer mirror as optical components for X-ray spectroscopy in the water window range

Water Window Range : C(285 eV) - O (530eV)



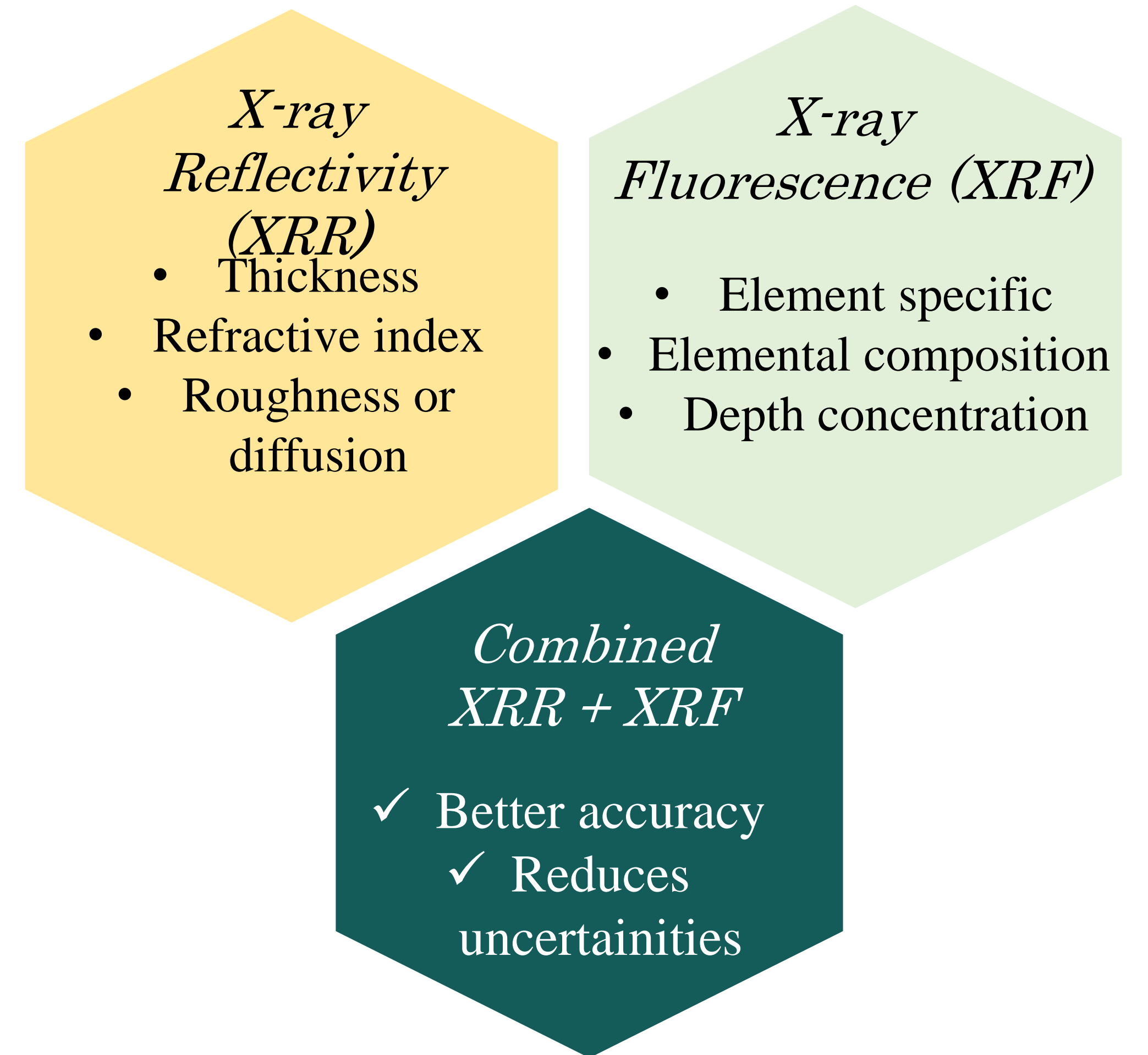
## Method of Analysis

CASTOR: Chambre d'Analyse spectrométrique en Transmission ou en Réflexion Metrologie Beamline, SOLEIL

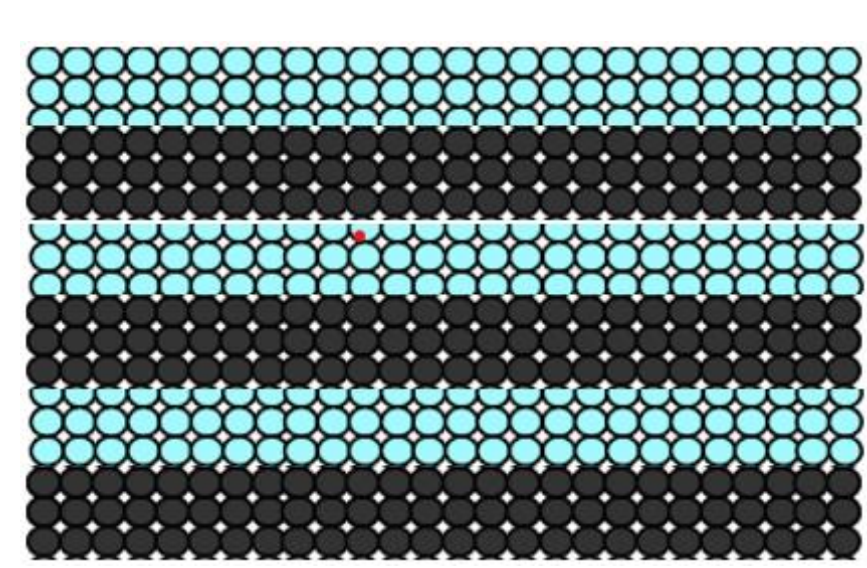


Seven-axis Goniometer

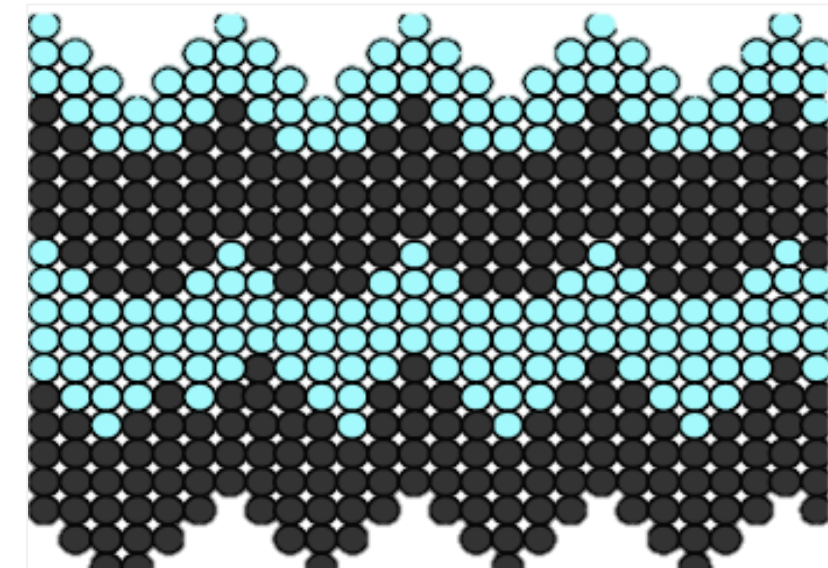
- ❖ Photodiode to record the XRR signal in a  $\theta$ - $2\theta$  configuration.
- ❖ Silicon drift detector (SDD), placed at  $90^\circ$  with respect to the incoming beam, to acquire the fluorescence one



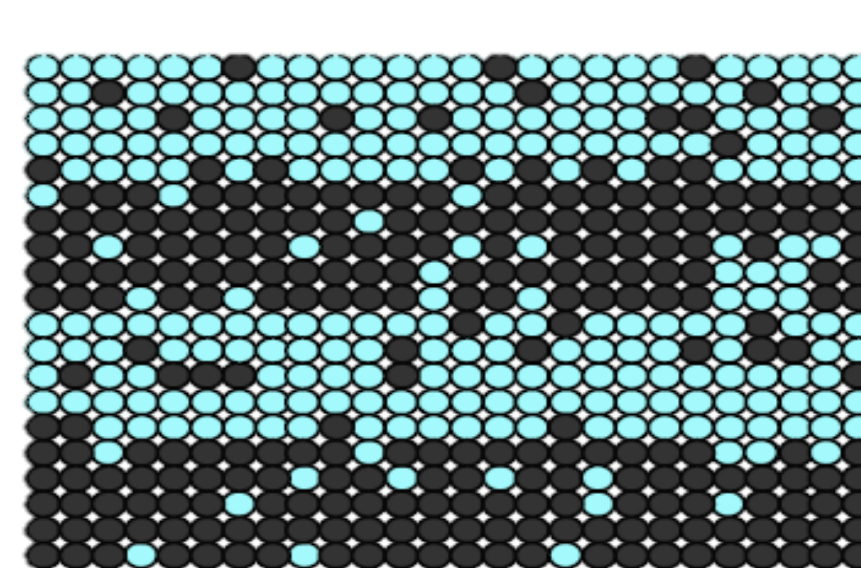
## Problem of Interfaces



Perfect Interface



Rough Interface

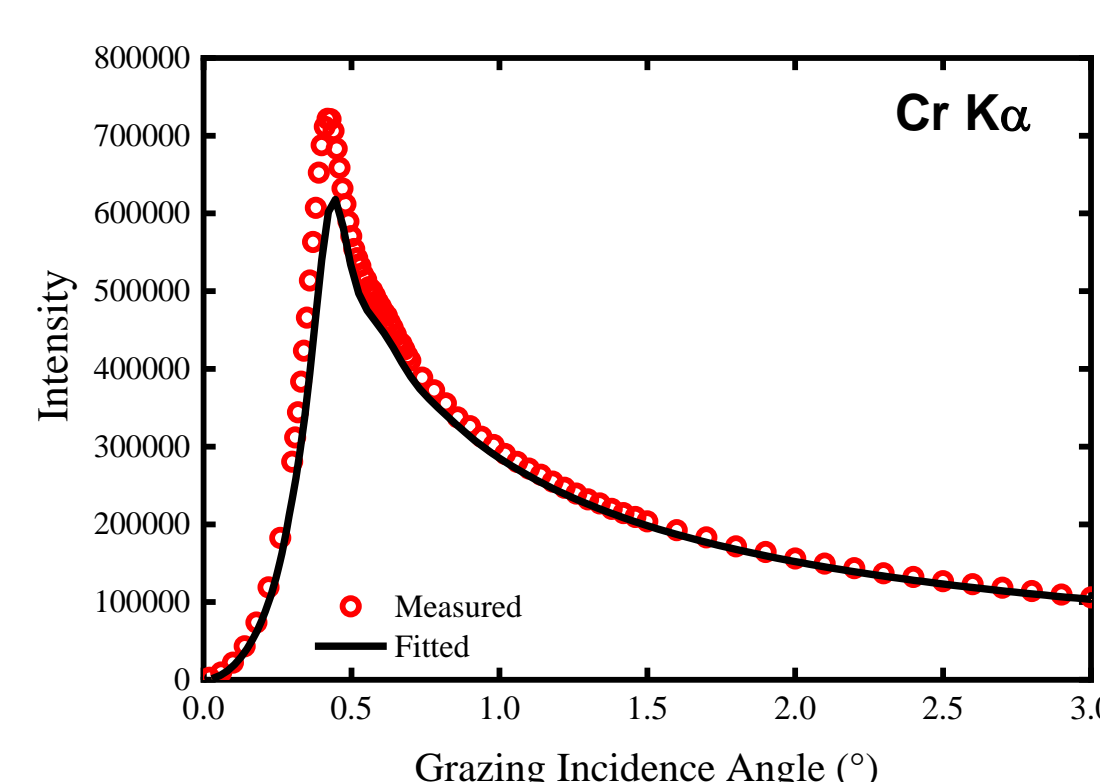
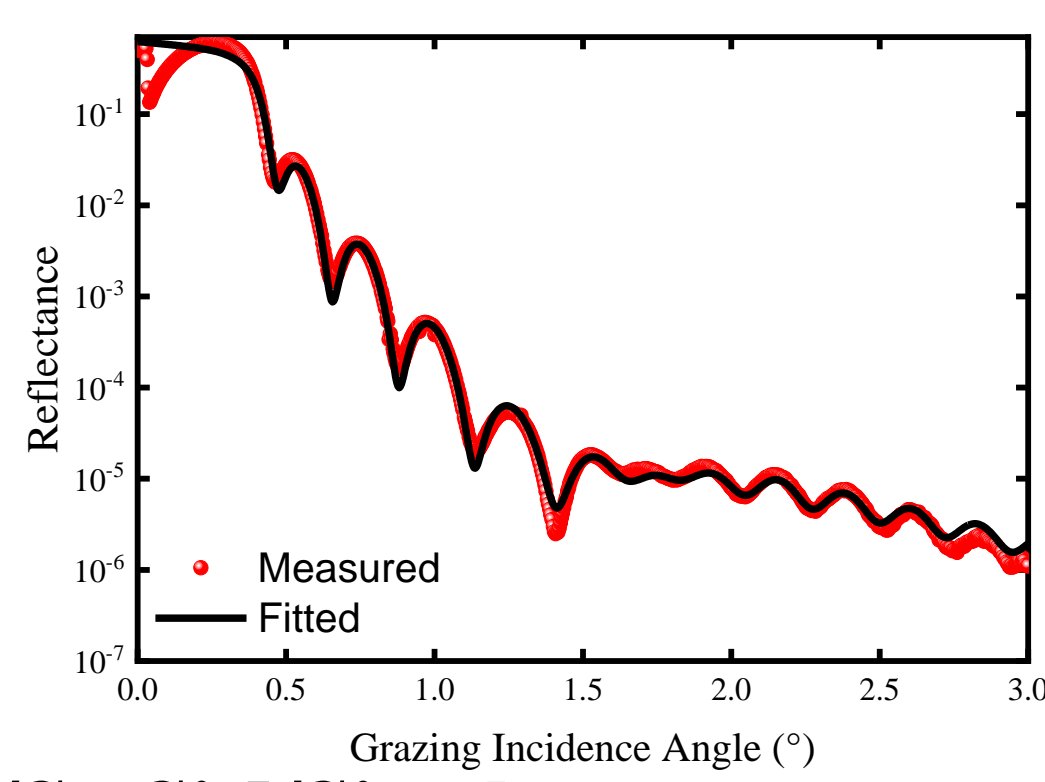


Diffused Interface

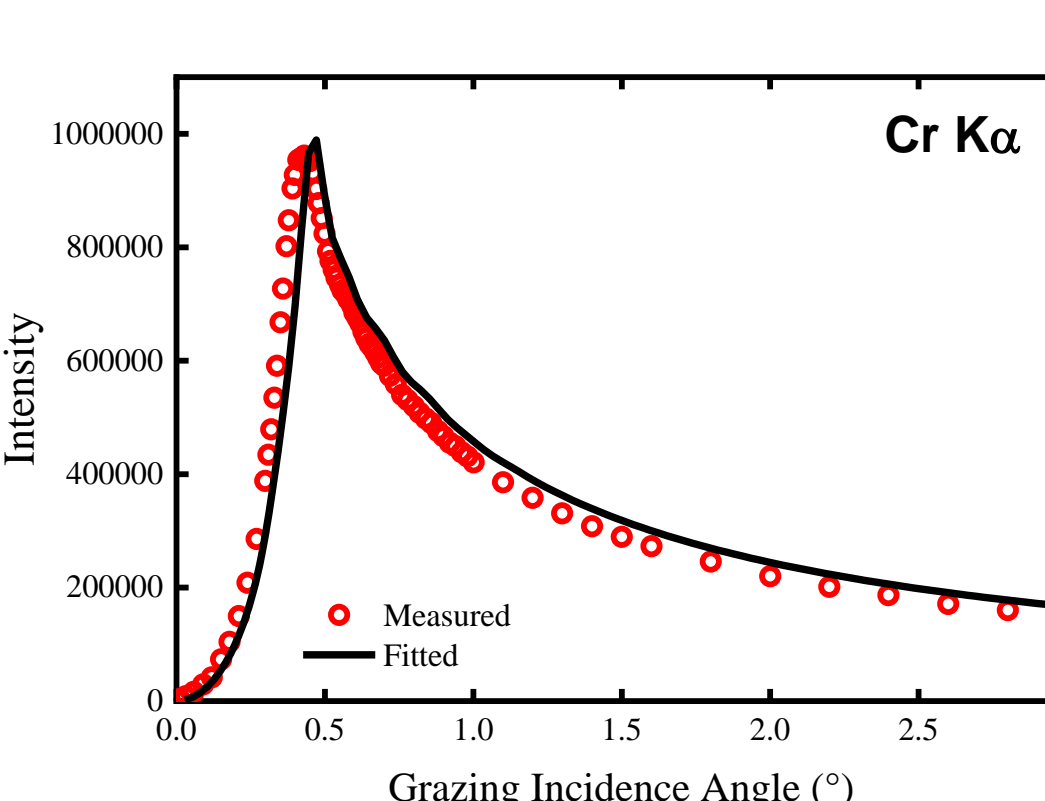
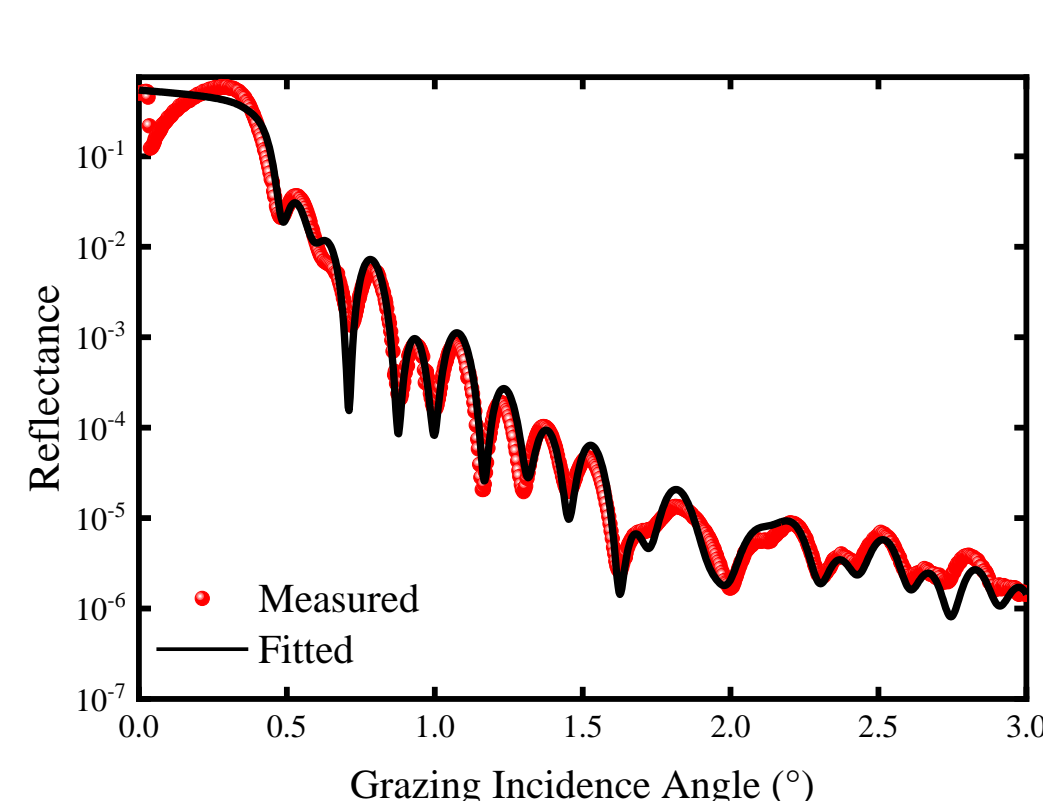
- *Mixing Enthalpy*
- *Method of Fabrication*
- *Stability of interfaces over time*
- *Free surface energy*

## Results

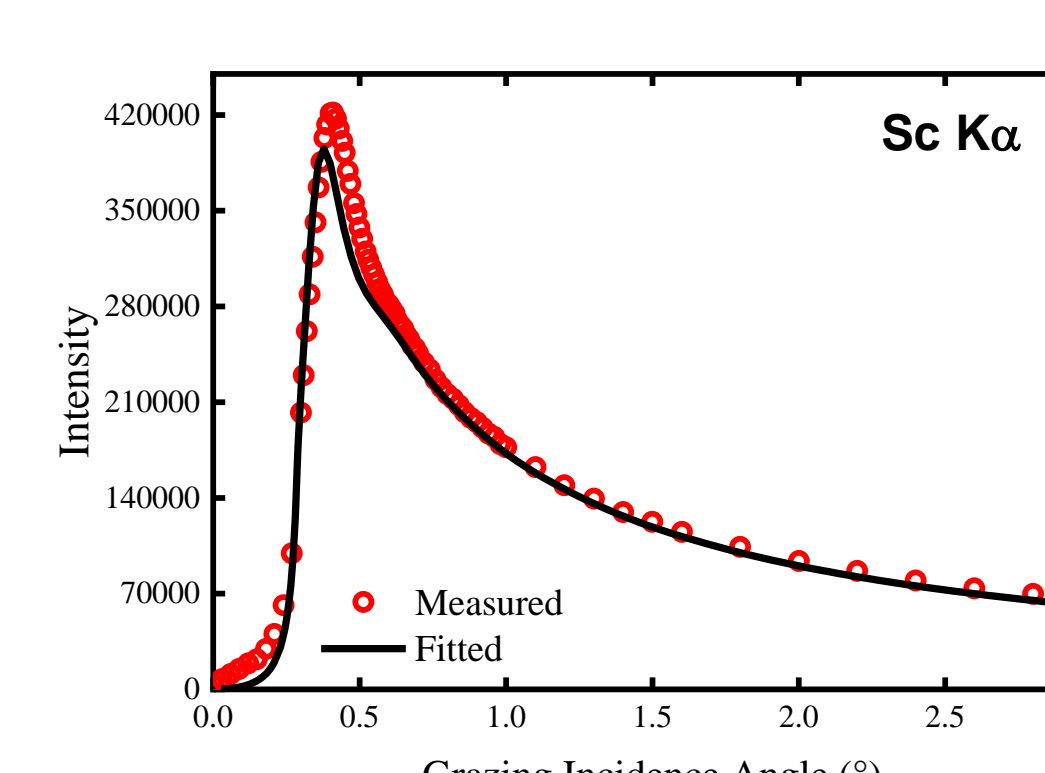
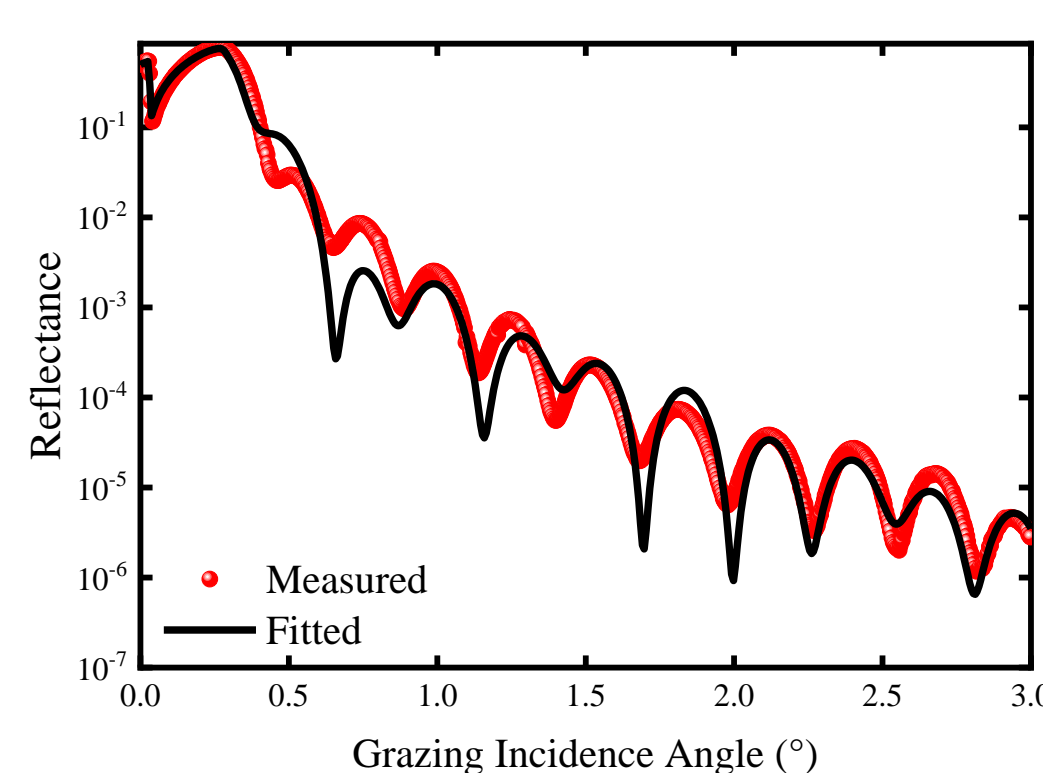
Fitted Structure:  $\text{CrO}_3/\text{Cr}_2\text{O}_3/\text{Mg}/\text{MgO}/\text{Si}$  substrate



Fitted Structure:  $\text{CrO}_3/\text{Cr}_2\text{O}_3/\text{Sc}/\text{Sc}_x\text{Si}_y/\text{Si}$  substrate



Fitted Structure:  $\text{CrO}_3/\text{Cr}_2\text{O}_3/\text{MgO}/\text{MgSc}/\text{Sc}/\text{Sc}_x\text{Si}_y/\text{Si}$  substrate



## Conclusion

