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Sergio Federico Mayer, Jean-Baptiste Ducros, Lauréline Lecarme, Claire Villevieille. Structural and Electrochemical Characterization of Thioantimoniate Sodium Solid Electrolyte. 74th Annual Meeting of the International Society of Electrochemistry, Sep 2023, Lyon, France. hal-04286324

HAL Id: hal-04286324

<https://hal.science/hal-04286324>

Submitted on 16 Nov 2023

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Structural and electrochemical characterization of sodium solid electrolyte

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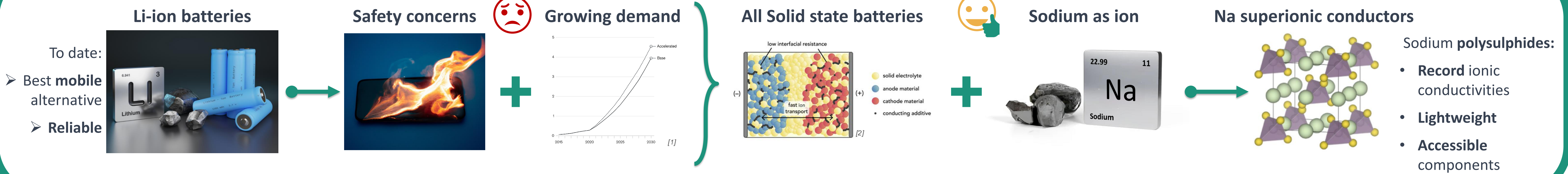
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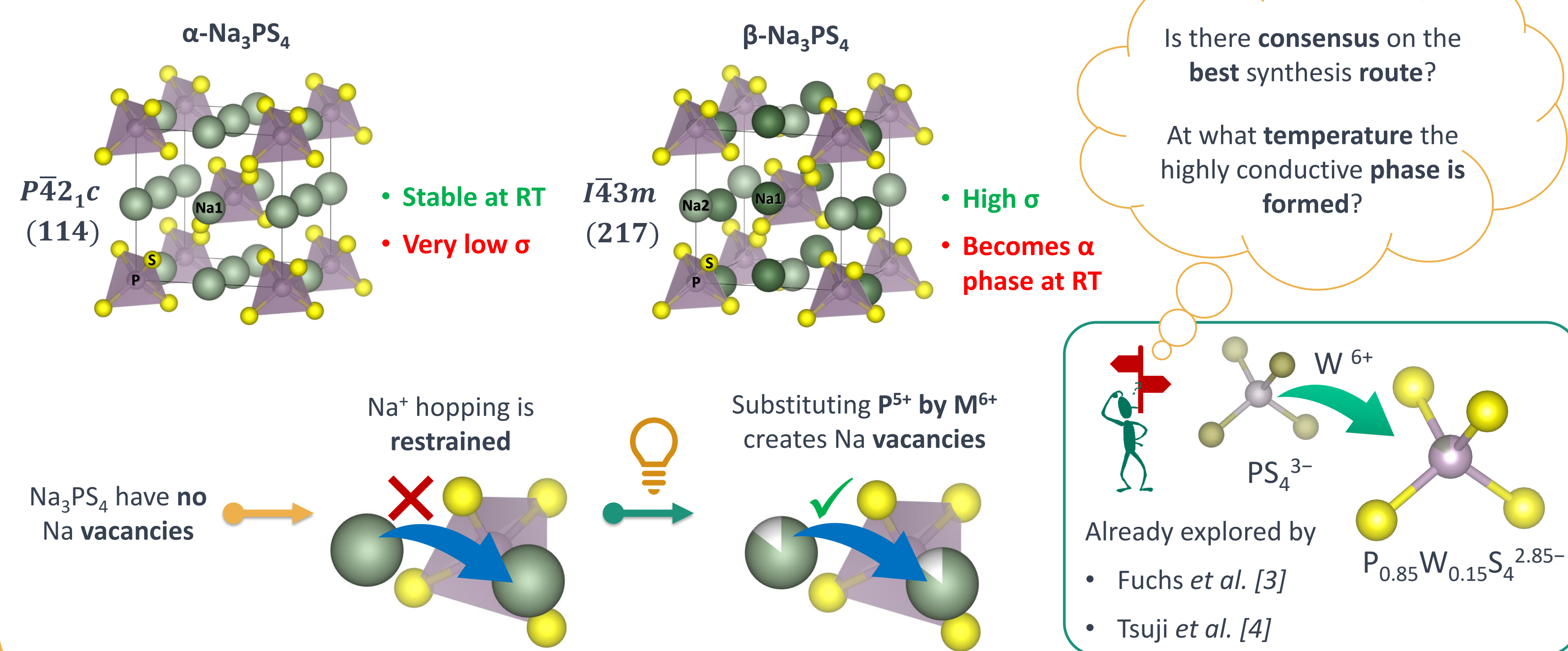
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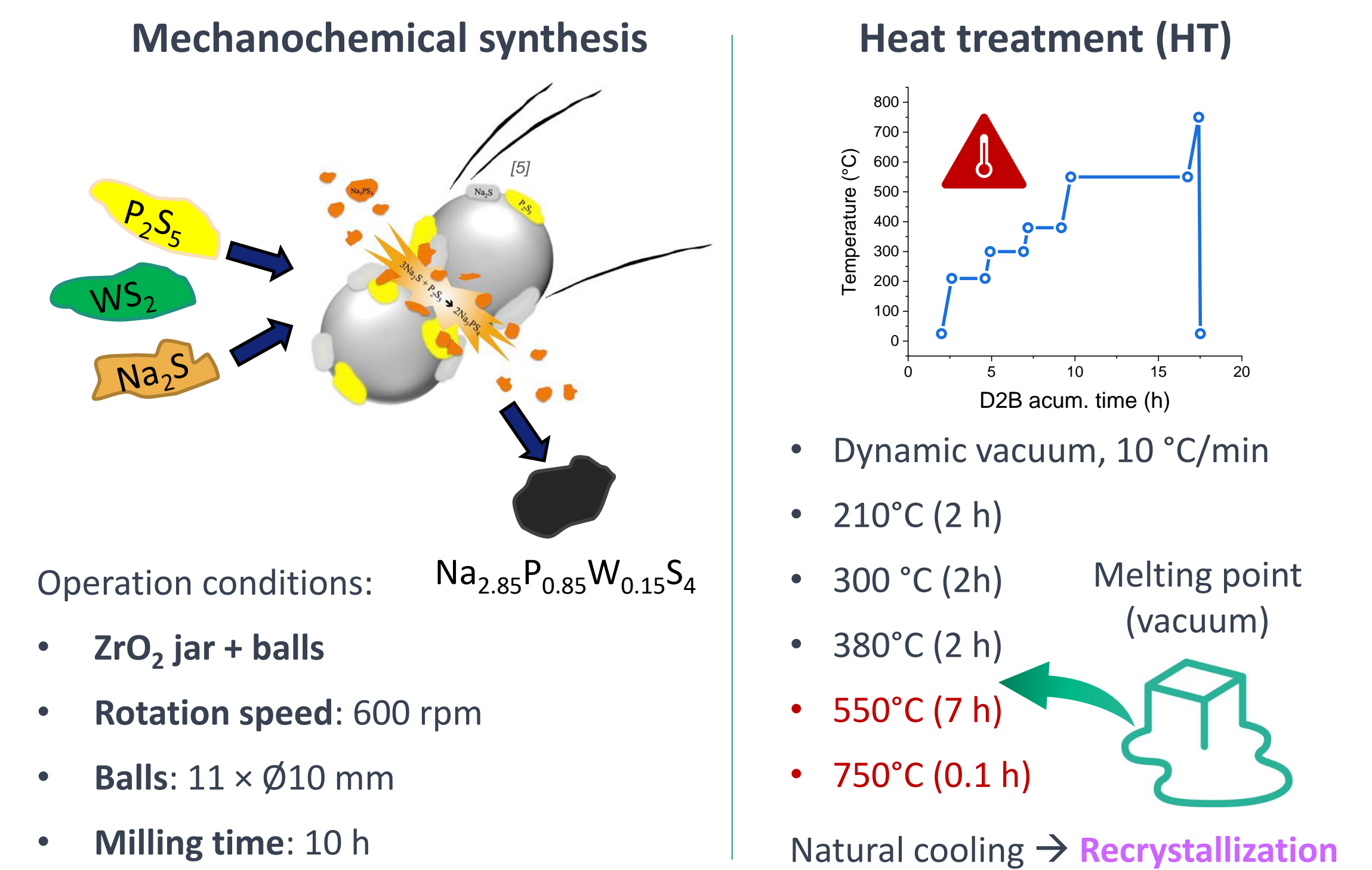
Introduction



Strategy

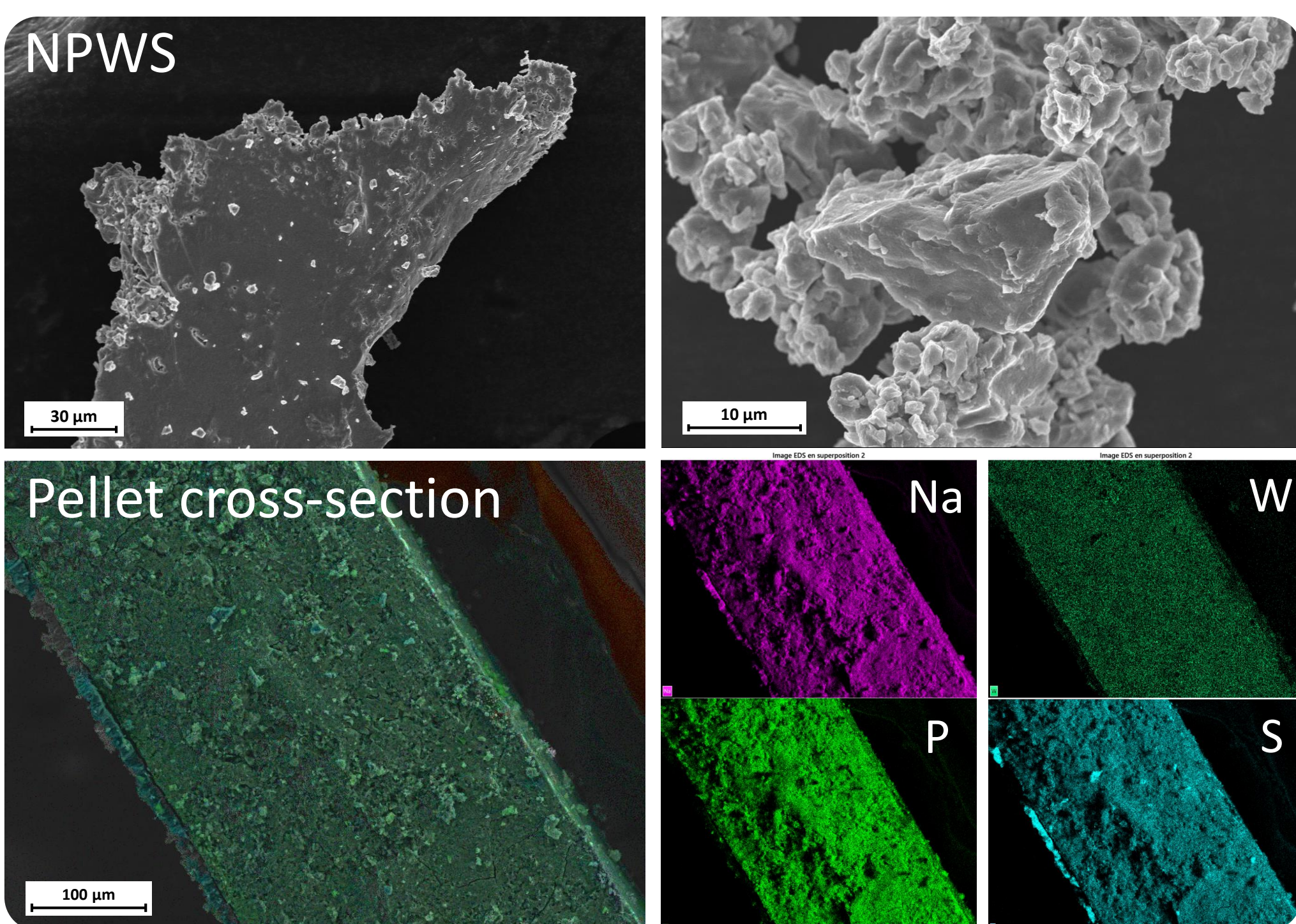


Methodology

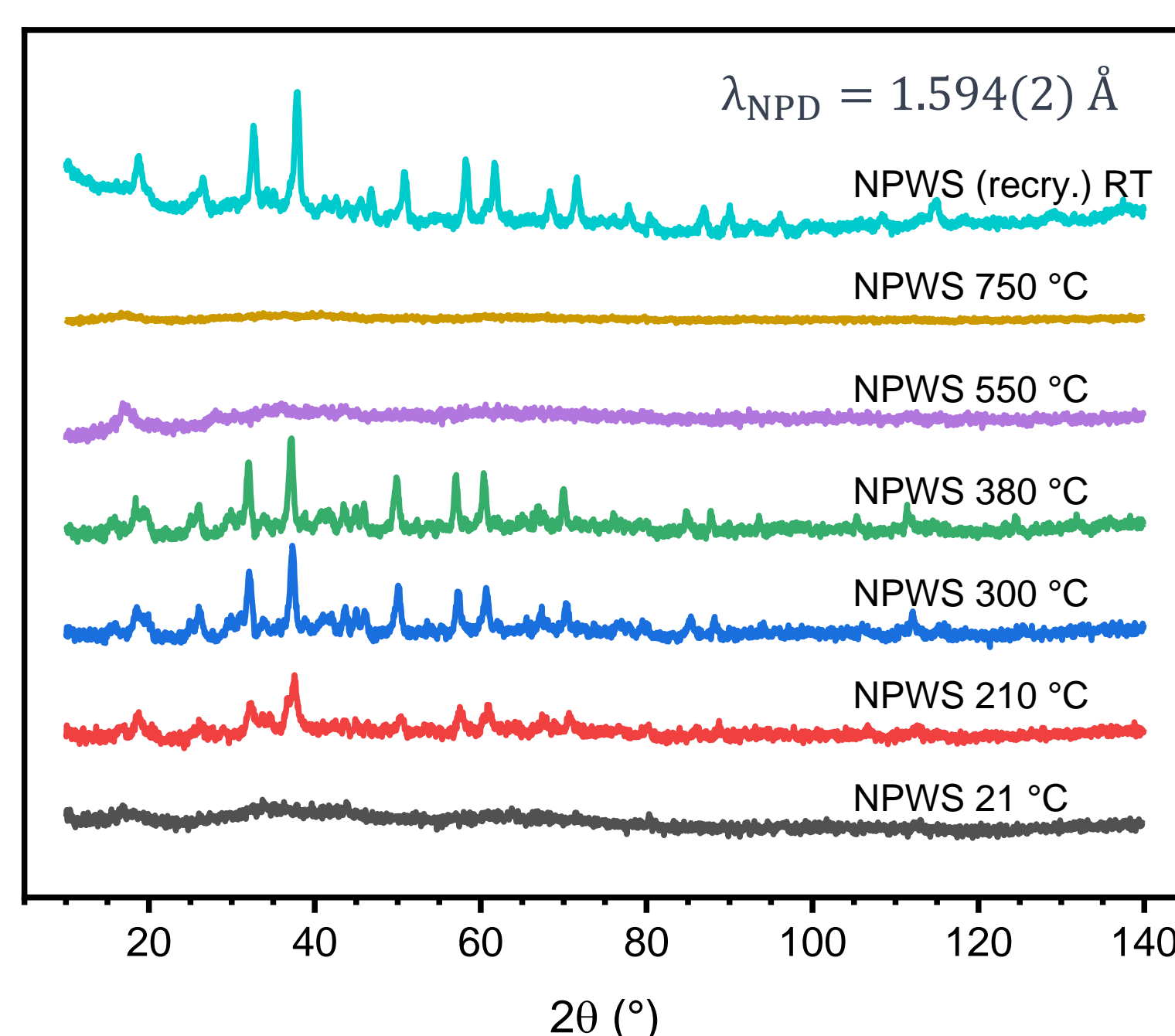


Results and discussion

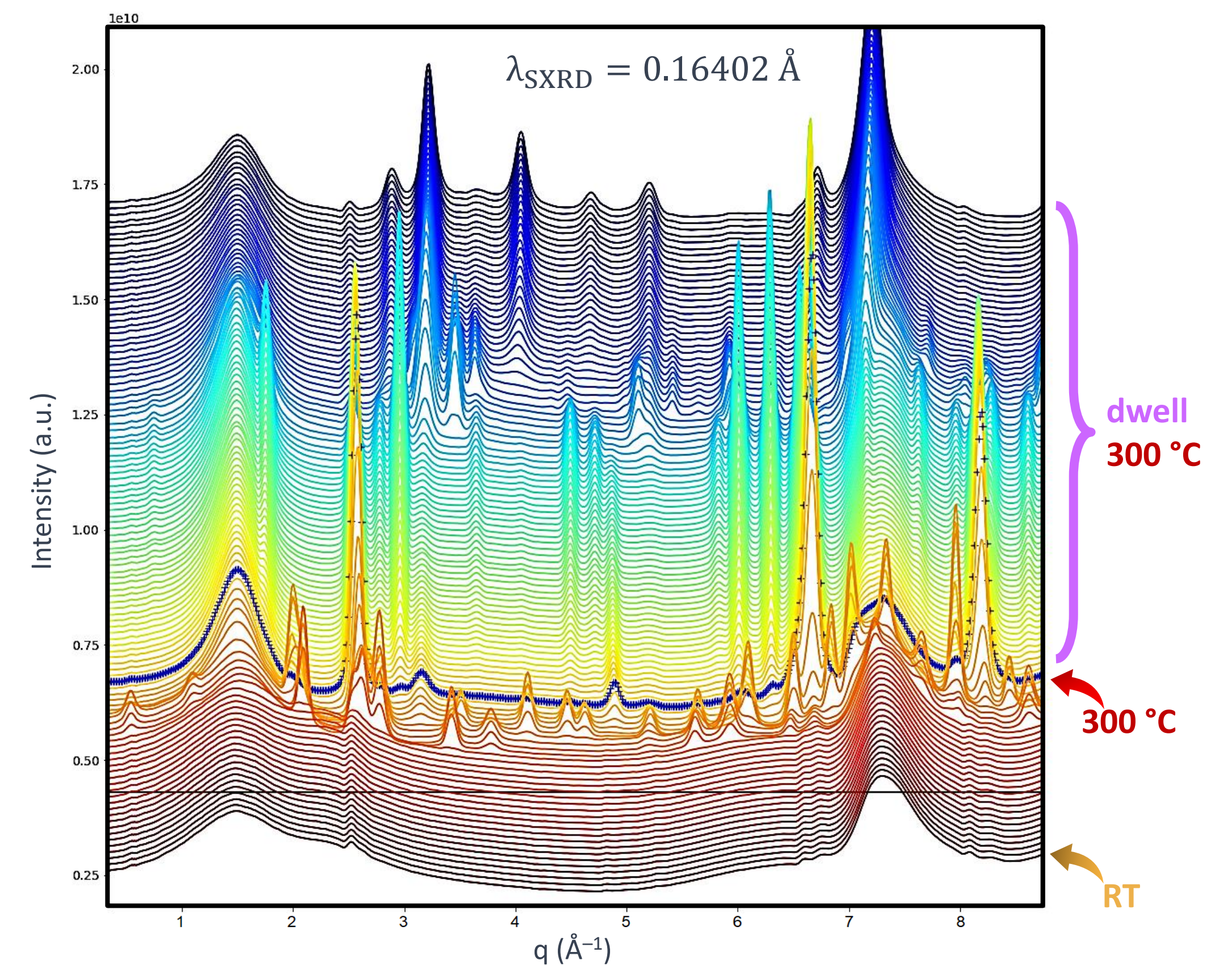
Na_{2.85}P_{0.85}W_{0.15}S₄ (NPWS) – Scanning electron microscopy-EDS



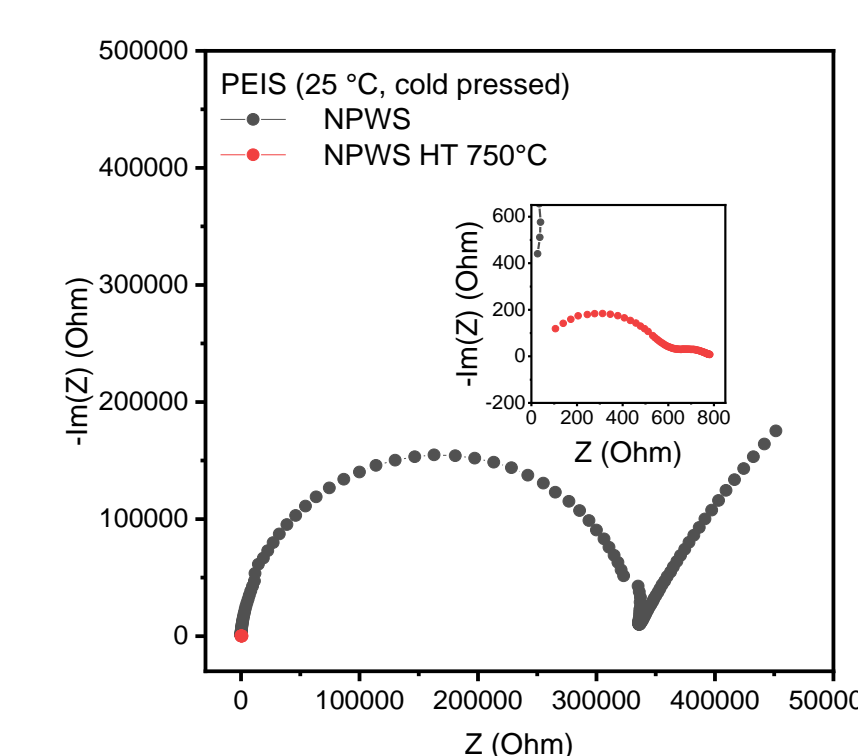
Neutron powder diffraction (NPD)



Synchrotron X-ray diffraction (SXRD)



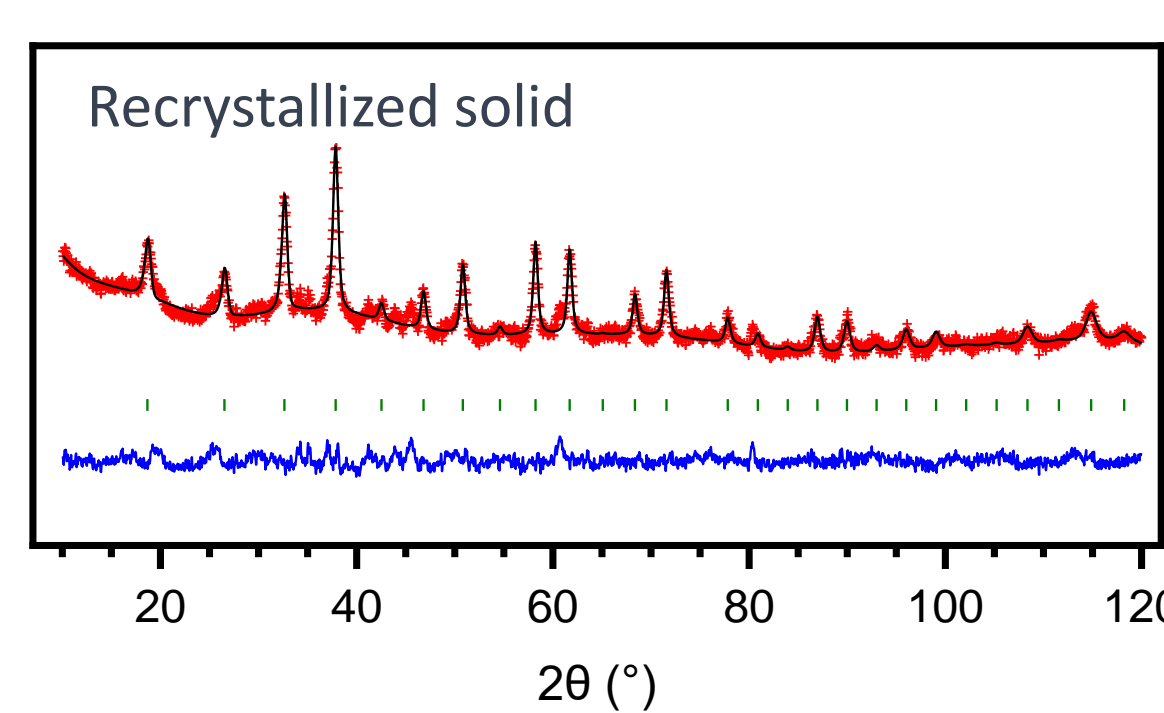
Impedance Spectroscopy (PEIS)



Sample	Compacity (%)	Ionic conductivity (S/cm)
NPWS	80.9	3.1 · 10 ⁻⁷
NPWS HT 750 °C	84.1	1.3 · 10 ⁻⁴

× 420 ✓

NPD Rietveld refinement



β -Na_{2.85}P_{0.85}W_{0.15}S₄

» Cubic $I\bar{4}3m$ (217) space group

» Na1 found in high multiplicity site

» $f_{occ} < 1$

✓ Percolation favoured

Na⁺ ions pathway (by BVEL)

Na⁺ ions pathway (by BVEL)

Conclusions and overview

Ball milled NPWS ➤ amorphous

Recrystallization ➤ β phase (stable at RT)

✓ Na hop favored ➔ $\sigma_{ion} \times 420$ ✓

• Transient phase @ ~275 °C

• Multiple phases during hold @ 300 °C

- Can they be isolated?

- Electrochemical performance?

• Phase identification @ ≠ time & Temp

• Long rest @ 300 °C & 380 °C (12 h)

• Electrical conductivity negligible? Electrochem. stability window, plating stripping, full cell...