

In Situ Synchrotron HE-XRD Investigation of Ternary Eutectic V-9Si-6.5B Alloy

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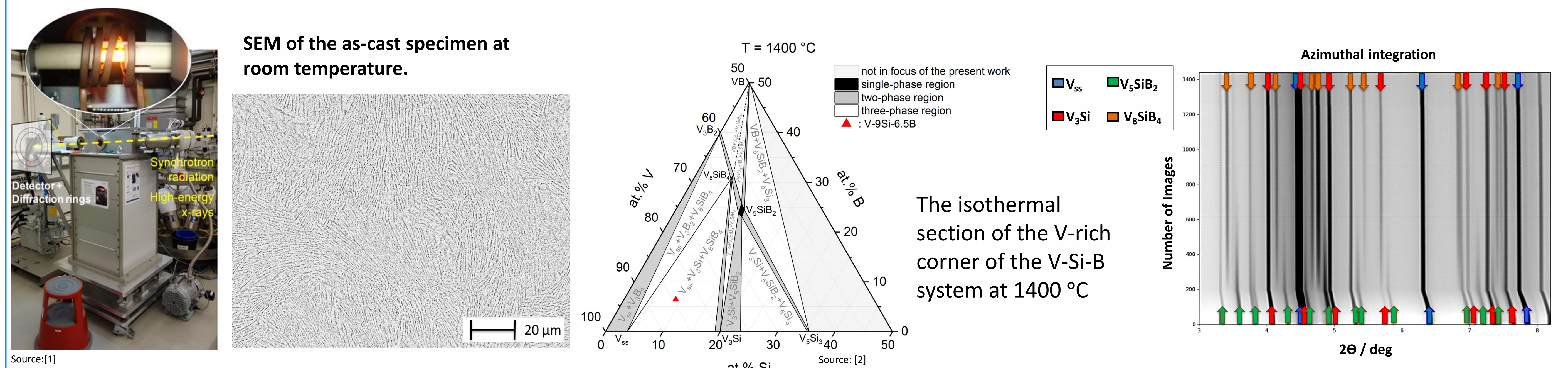
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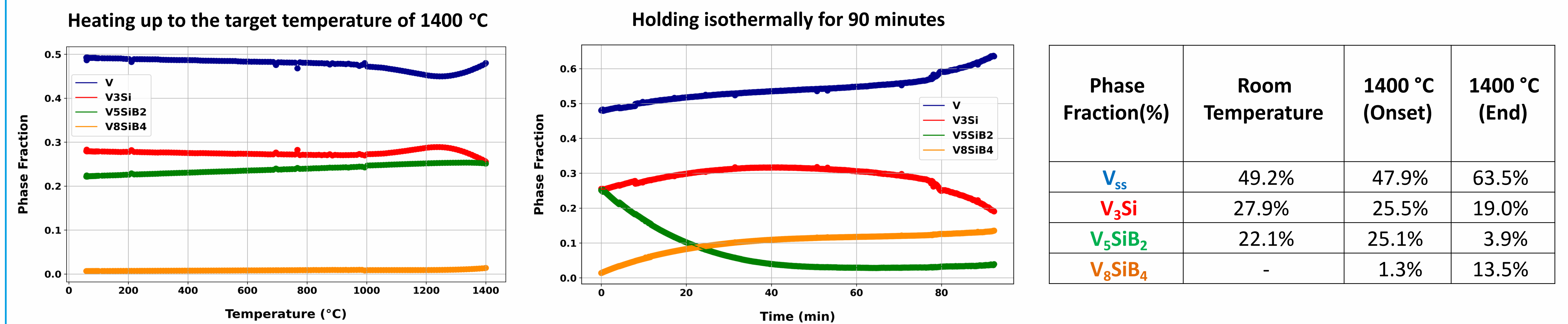
Introduction

To understand the mechanisms governing intermetallic stability under extreme thermal conditions, this study investigates phase transitions in a ternary eutectic **V-9Si-6.5B** (at.%) alloy. By combining synchrotron high-energy X-ray diffraction (HE-XRD) with dilatometry, an in situ analysis was performed to monitor the real-time evolution of the V_{SS} solid solution and the intermetallic phases V_3Si , V_5SiB_2 , and the novel V_8SiB_4 in real time from ambient temperature to 1400 °C.

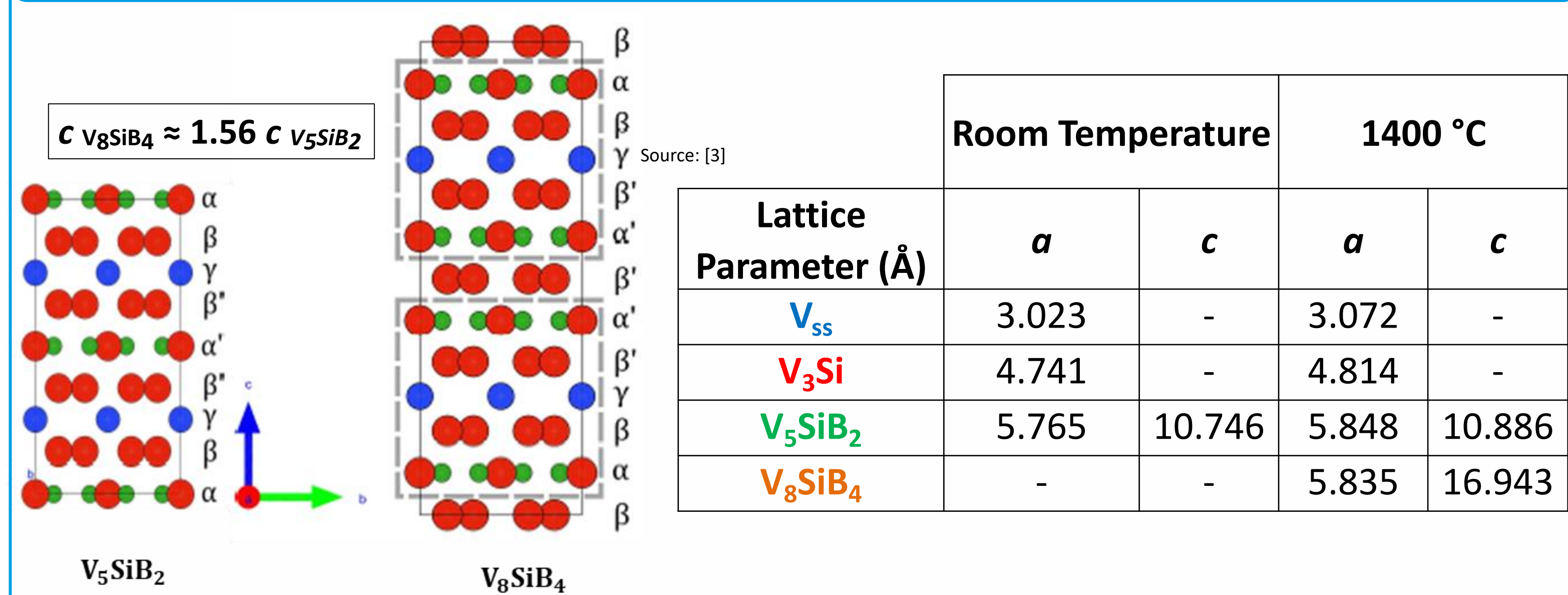
Methods and Processing



Influence of thermal treatment on phase stability and transformation



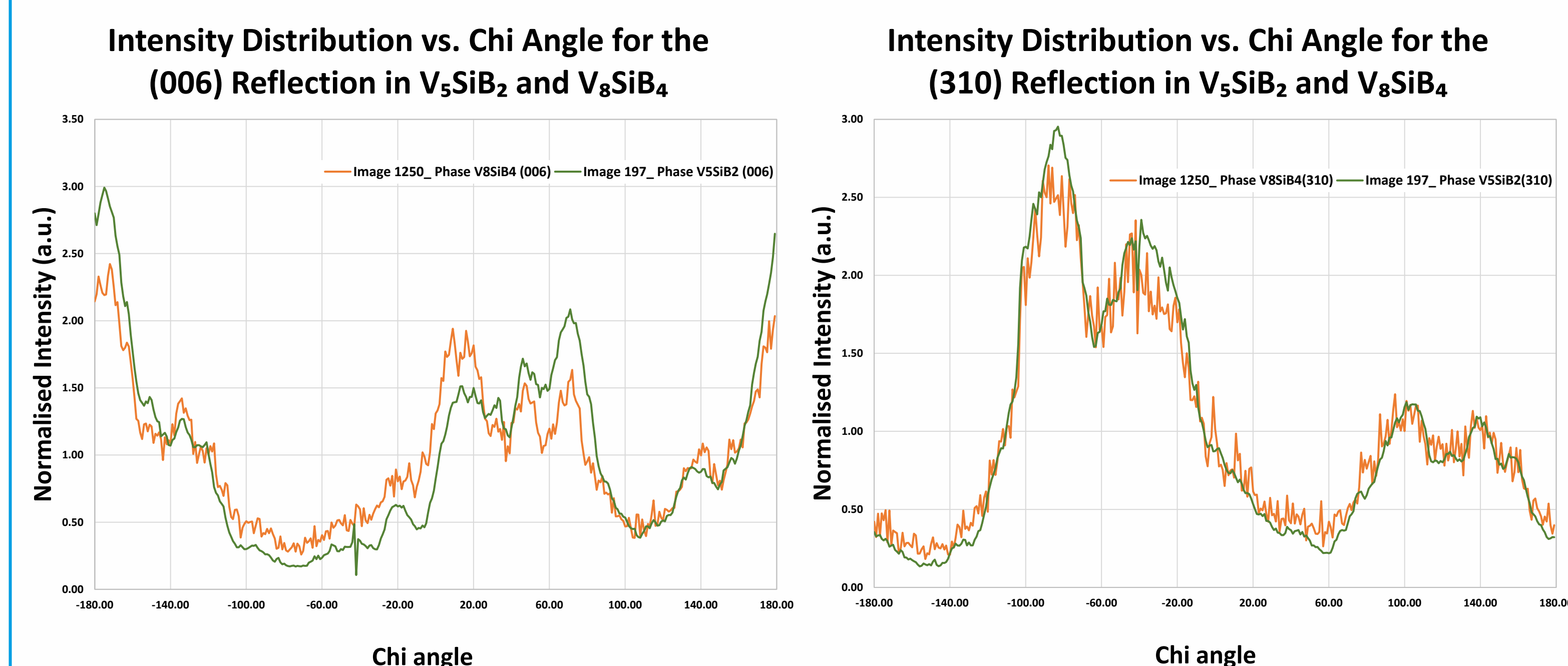
Evolution of the lattice parameters



Main findings

- V_8SiB_4 nucleates at temperature above 1300 °C.
- Decomposition of the V_5SiB_2 phase and the concurrent formation and growth of the V_8SiB_4 phase during the 90-minute isothermal hold at 1400 °C were observed.
- Intensity Distribution revealed:
 - ❖ V_8SiB_4 phase inherits the general orientation of the parent V_5SiB_2 phase.
 - ❖ Atomic rearrangement in the V_8SiB_4 phase occurred along the crystallographic c-axis.
 - ❖ V_{SS} and V_3Si phases show textural stability during the annealing.

Intensity Distribution



References

1. Stark, Andreas, et al. "In situ high-energy X-ray diffraction during hot-forming of a multiphase TiAl alloy." *Metals* 5.4 (2015): 2252-2265.
2. Yang, Weiguang, et al. "Phase Equilibria in the V-Rich Region of the V-Si-B System at 1400 °C." *Journal of Phase Equilibria and Diffusion* 46.1 (2025): 151-169.
3. Yang, W. G., et al. " V_8SiB_4 —A new ternary phase in the V-Si-B system." *Intermetallics* 151 (2022): 107691.