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On the Microstructural Characterization of an AA1100 – 25 vol.% B_4C Composite

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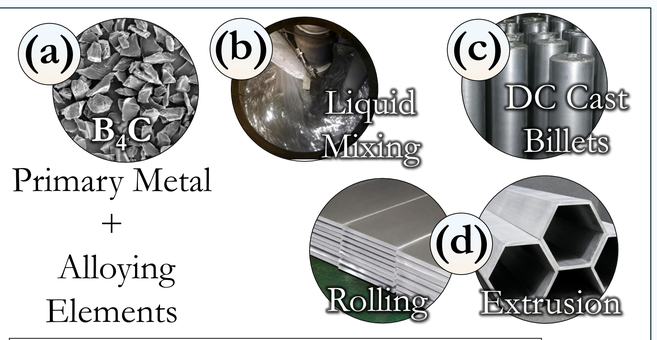
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Why This Composite?

- Low density
- High neutron-absorption capability
- Aluminium processability
- Structural integrity
- Potential application in spent-fuel storage



AA1100–B_4C Fabrication Route

What are the actual microstructural characteristics of a commercial metal matrix composite?

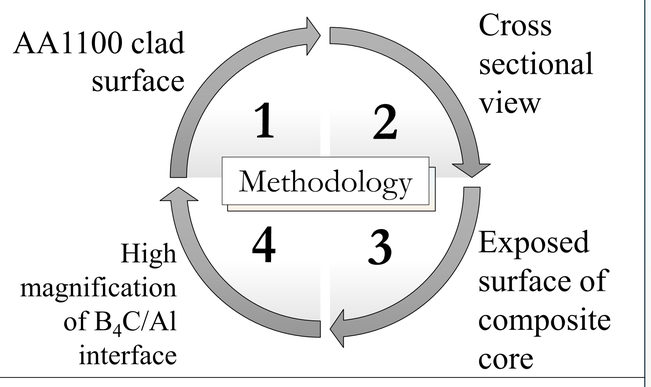
Experimental Approach



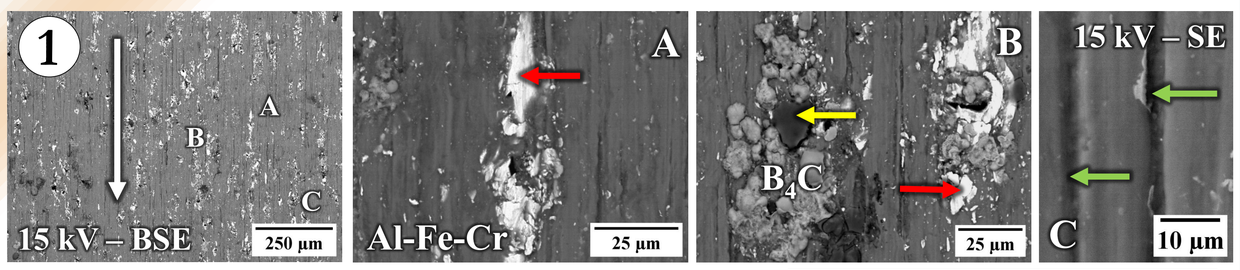
AA1100 matrix: Al balance, Fe 0.32, Si 0.18, Cu 0.10 wt.%

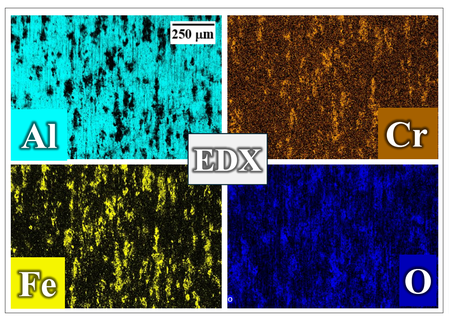
Composite: 25 vol.% B_4C + ~2.6 wt.% Ti

Advanced Metal Matrix Composite



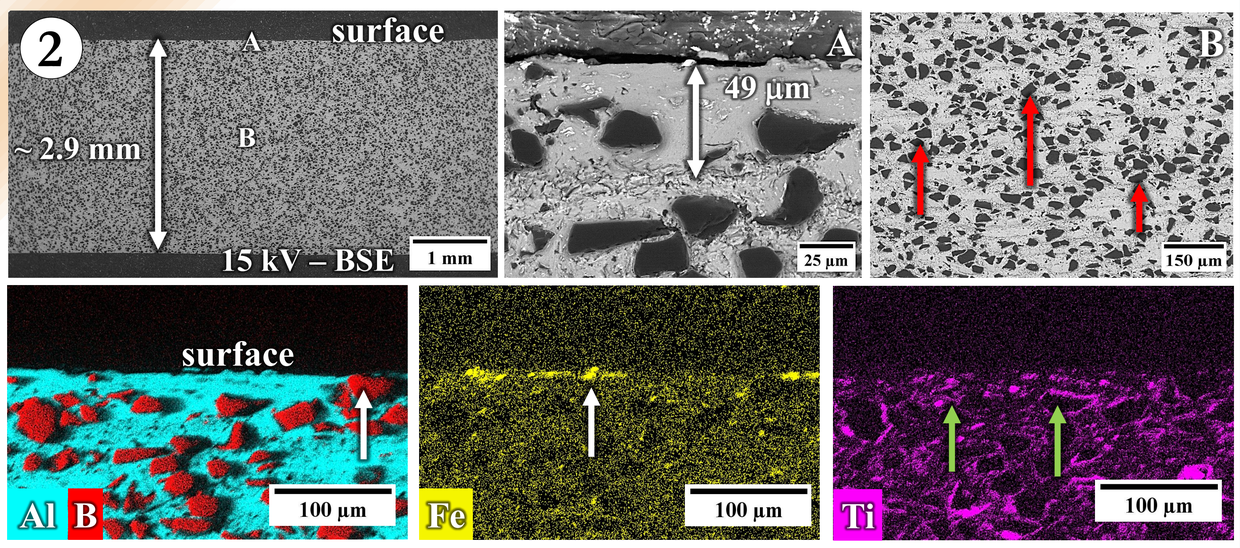
Optical profilometry	Scanning Kelvin Probe Force Microscopy (SKPFM)	FEG-SEM EDX	FIB TEM/SAED	HAADF-STEM/STEM-EDX





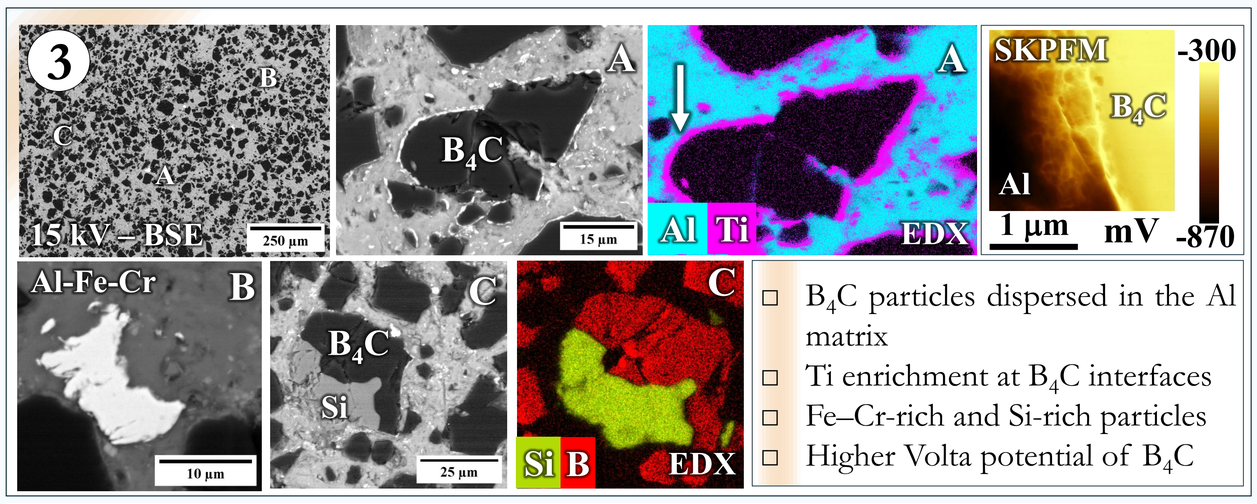
AA1100 clad heterogeneity

- Fe–Cr-rich particles aligned with the rolling direction
- O-rich regions and occasional B_4C near the clad surface
- Rolling grooves parallel to the processing direction

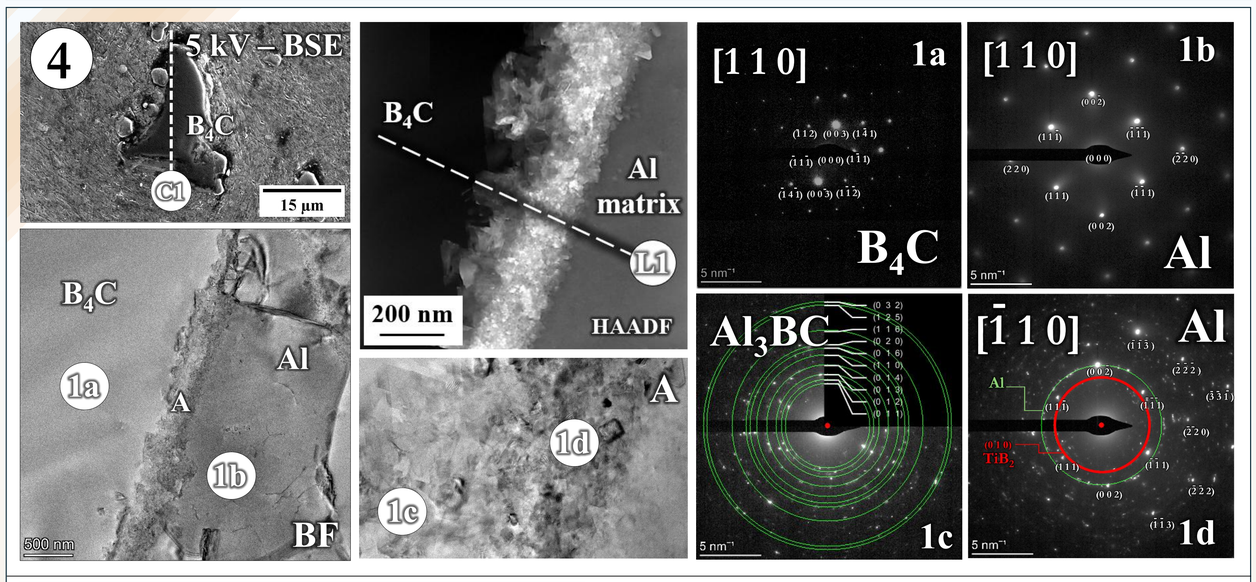


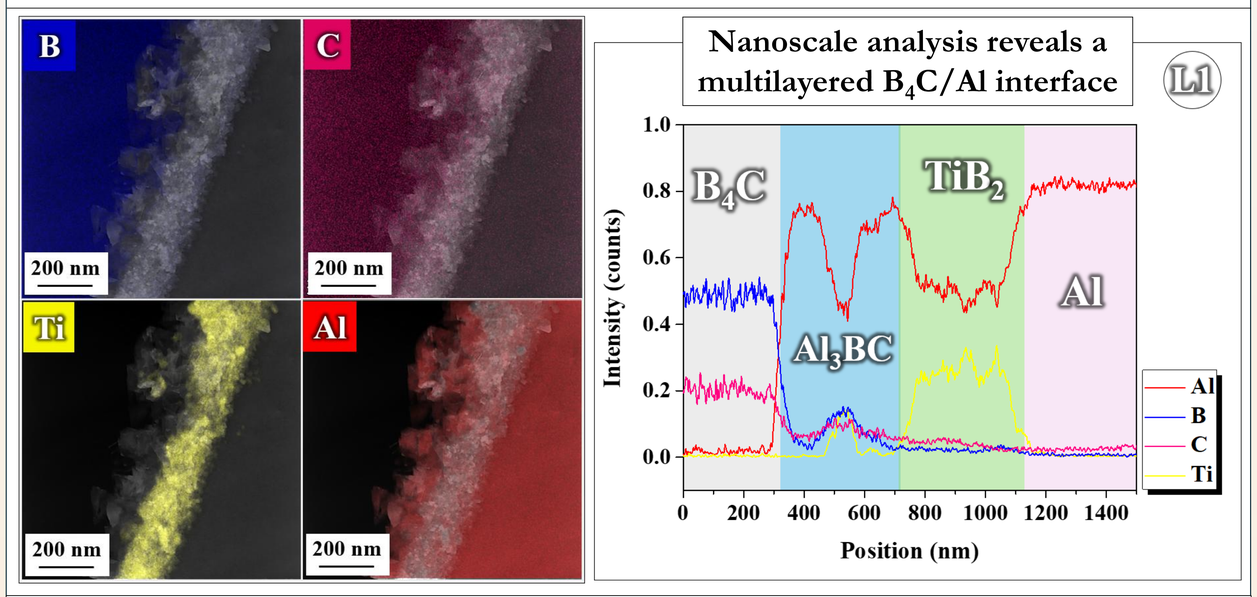
- AA1100 clad/composite core architecture
- Clad thickness: 40 ± 15 µm
- B_4C particles dispersed throughout the core
- Ti-rich regions associated with B_4C particles

What is revealed after removing the AA1100 clad?



- B_4C particles dispersed in the Al matrix
- Ti enrichment at B_4C interfaces
- Fe–Cr-rich and Si-rich particles
- Higher Volta potential of B_4C





Conclusions

- The commercial AA1100–25 vol.% B_4C composite exhibits a clad/core architecture, with angular B_4C particles relatively homogeneously distributed in the Al matrix.
- Fe-Cr-rich and Si-rich secondary particles contribute to the local microstructural heterogeneity of the composite.
- The B_4C particles are not in direct contact with the Al matrix, but are separated by a multilayered interface described as $B_4C/Al_3BC/TiB_2/Al$.
- Ti addition promoted the formation of a TiB_2-rich interfacial layer, contributing to control of the B_4C/Al reaction, although the presence of Al_3BC indicates that the reaction was only partially suppressed.

References

[1] Ibrahim, M.F. et al. IntechOpen (2021).
[2] Rao, Y. et al. J. Nucl. Mater. 629 (2026) 156671.
[3] Guo, W. et al. Appl. Surf. Sci. 584 (2022) 152619.

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