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Study of the sintering and oxidation behavior to the HfB₂/SiC system. Synthesis, reactivity and chemical-physical characterization.



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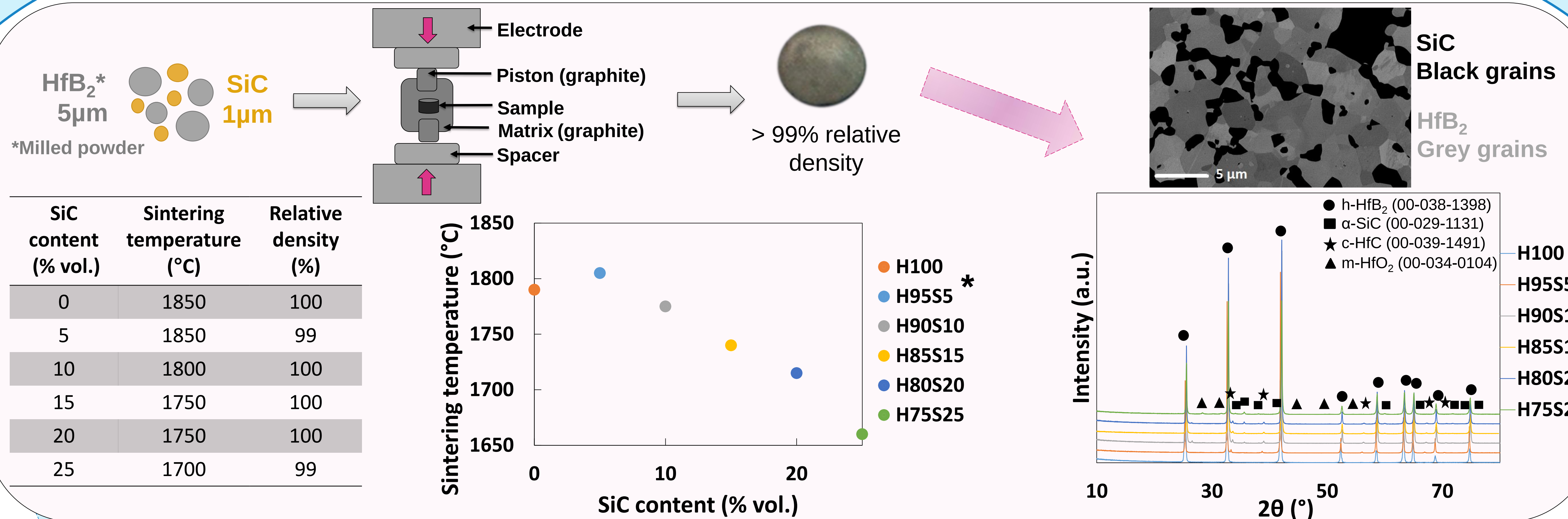


Introduction

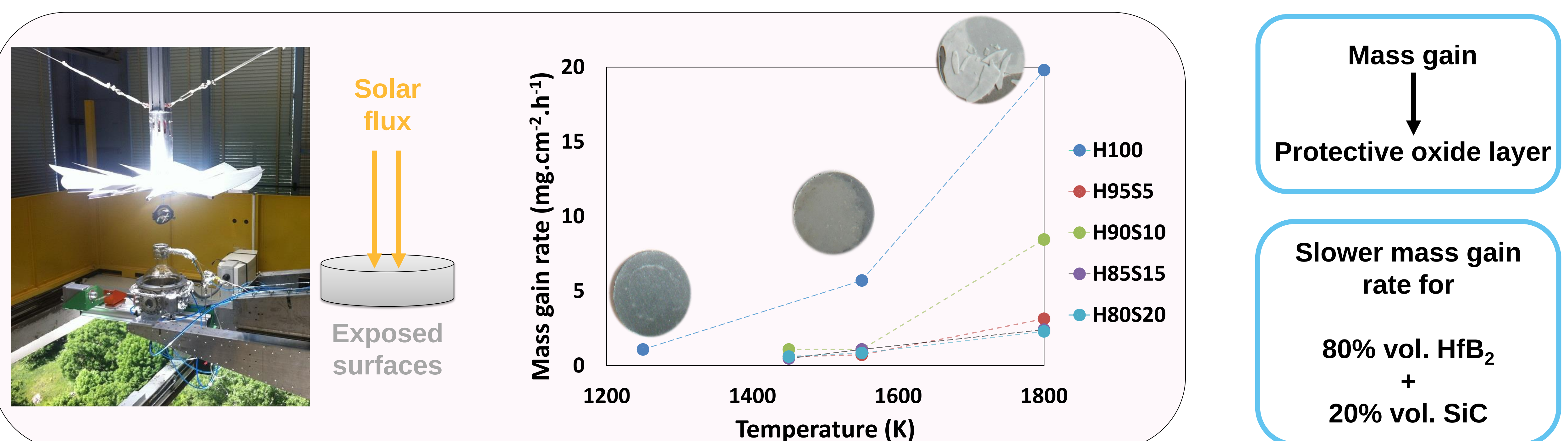
The first aim of our work consists in synthesizing Ultra High Temperature HfB₂/SiC ceramics, used as structural materials in aeronautic and aerospace areas, by Spark Plasma Sintering (SPS). This process is used to obtain fully dense materials (>99% relative density) with fine grains, at lower sintering temperature and shorter dwell time than conventional techniques. Sintered materials are then oxidized in a solar furnace and characterized in order to better understand the oxidation mechanisms.

Study of sintering and oxidation behaviour

Spark Plasma Sintering (SPS)



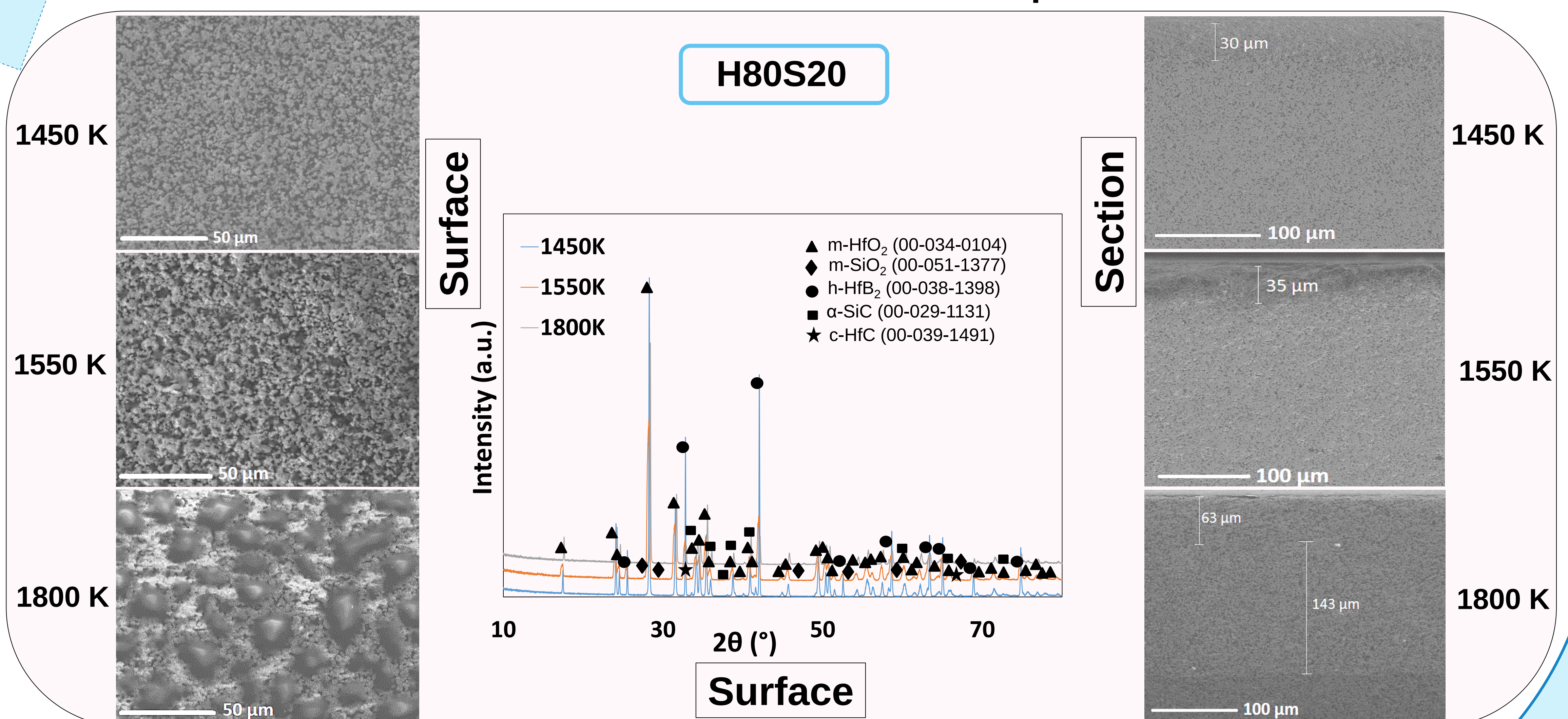
Oxidation in solar furnace



Characterization of oxidized products

- Appearance of hafnium and silicon dioxides
- Increase of dioxides intensity peaks with temperature

- Silicon carbide grains growth with oxidation temperature
- External oxide layer growth with oxidation temperature



* H95S5: 95% vol. of milled HfB₂ + 5% vol. SiC

The milling was carried out in a planetary mill during 30 minutes containing 6 cycles of 6 minutes (1 minute of milling and 5 minutes rest).

Conclusion

- Sintering of fully dense HfB₂/SiC ceramics by Spark Plasma Sintering
- Decrease of sintering temperature with the addition of silicon carbide
- Oxidation tests carried out with a solar furnace up to 1800K under stagnant air

- Slower mass gain rate for the composition 80% vol. HfB₂ + 20% vol. SiC
- Different microstructures observed depending on the oxidation temperature and ceramic composition.