

Comparison between conventional and unconventional methods of sintering Inconel 718 MIM samples

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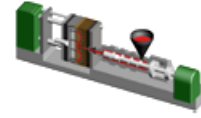
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Objectives and Techniques

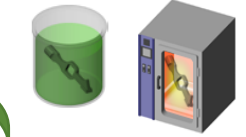
- MIM process allows the **mass production** of **small complex samples** but the conventional way of sintering are **consuming a lot of time and energy**
- **Finding new ways** of sintering MIM samples in order to **improve the sintering time** and/or the **mechanical properties**
- **FAHP** (Field assisted Hot Pressing) is a sintering process using electric current going through the material put under pressure
- **Inconel 718** is a Nickel based super-alloy which needs **control of the environment** in order to avoid oxidation or carbon pollution

MIM process

Injection molding

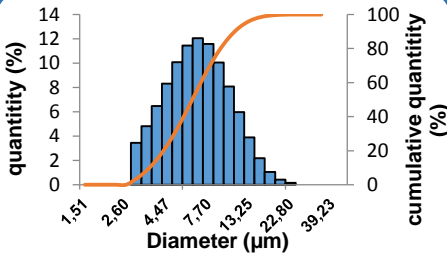


Solvent and/or thermal debinding



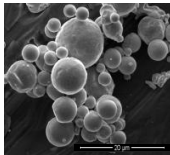
Sintering

Powder Characterization

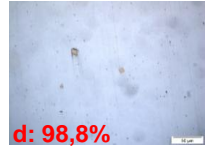
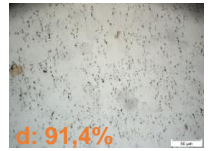
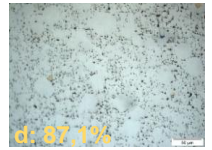
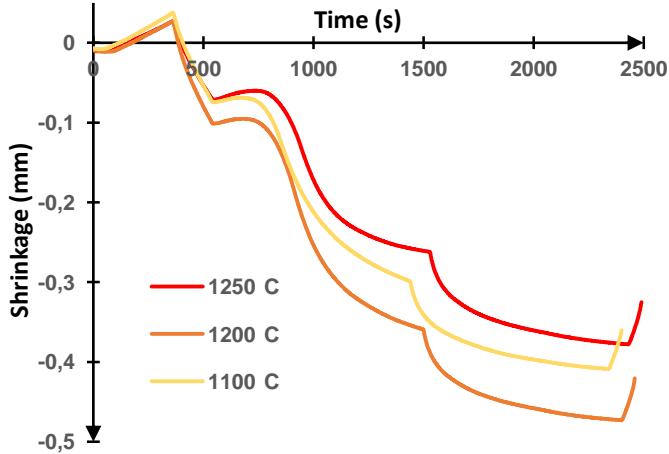


-Inconel powder mixed with a CAB+PEG binder and injected into green parts

- The Green parts are debinded in water and thermally at 500 C during 2 hours

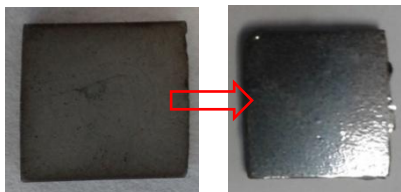


Optimization of the Temperature



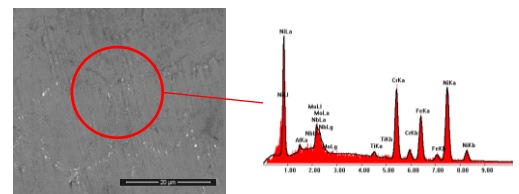
Comparison between the methods

Method	Conventional	FAHP	FAHP
sample	MIM	powder	MIM-preform
Temperature	1290°C	1250 °C	1250°C
Dwell	2h	10 min	10 min
Pressure	-	50 MPa	5 MPa
density	96,70%	98,80%	94,50%
hardness	211,3	300,2	256,3



- MIM preform: pre-sintering at 700 C during 2 hours and FAHP processed at a min. pressure of 5 Mpa in order to avoid damage to the shape

EDX of the MIM-preform sample



- No carbon pollution or oxidation observed
- Microstructure impacted by the pre-forming

Conclusion

- **Optimization** of the sintering of Inconel 718 powder by FAHP method
- The **shape** of the MIM sample given during the injection is **the same** after sintering
- **Pre-sintering** the green sample allows keeping the shape but is **impacting the grain size** and the mechanical properties