

Towards a better comprehension of high-pressure sintering mechanisms through in situ approach.

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Powder sintering is based on diffusion mechanisms, densifying or not, activated by energy input. To enhance its energy efficiency, reduction of sintering temperature is a major challenge. Some advanced techniques (Hot Pressing, high pressure, Cold Sintering Process, Spark Plasma Sintering, ...) enable reaching high density while reducing sintering temperature compared to conventional processes (Cottrino et al. 2025, Le Godec et al 2023).

Comprehension of the mechanisms at crystallites size, as well as the influence of sintering technique, parameters and material characteristics makes it possible to optimise these processes. This topic has already been studied mainly through *ex situ/post mortem* approaches, at material macroscopic scale. However, sintering is governed by high rate transitory mechanisms at the grain scale. An *in situ* approach, at micro or even nano scale is relevant (Pontoreau et al. 2023).

Using an eSEM *in situ* compression/heating stage, first-stage sintering (conventional, HP, CSP, etc) mechanisms can be followed at grain scale, first at low temperature and pressure, then at higher values approaching conventional sintering conditions. This "live" study allows monitoring the formation of necks between particle and progressive closure of porosities. Based on model materials (ZnO, TiO₂) the combination of *ex situ* and *in situ* approaches allows a deepen understanding of the different sintering mechanisms in order to optimize them.

Professional Status of the Speaker

Doctoral or Master Student

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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