# Numerical FE approach dedicated to microscale modeling of the densification of powders by the HIP process

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Hot Isostatic Pressing (HIP) of prelloyed powders appears as a key process for large complex parts. It offers many benefits versus the conventional casting+forging route with a simplification of production fluxes, material savings, homogeneity of chemical composition, better controllability of parts and a shorter lead-time by reducing machining and welding operations. To speed up the design of components and of the HIP tooling (containers), finite element modelling of HIP has been developed for a long time. Different simulation codes are available to model the process at a macroscopic scale (using the so-called "mean-field" modelling). However, the physics of HIP is quite complex: during the first stages, densification is driven by the plastic deformation of particles at high temperature, while in the later stages, final porosity closure and the growth of metallurgical grains are controlled by transport of matter by diffusion, at the surface of particles, through particles interfaces or through grain boundaries. Because of this complexity, mean field macroscopic numerical modelling has been shown not predictive enough. Then efficient and robust FE multiscale numerical framework for the simulation of HIP process begins to emerge. This framework will be introduced.