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Efficient modeling of very large NNS parts (up to 3 meter diameter) and key parameters to control dimensional scattering in a +- 15 mm range.

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The paper addresses the challenging scientific and technological tasks of achieving limitation of over thickness to 1% of a linear dimension in HIPing Near Net shape PM Components of large size up to 3 meter diameter. To reach this goal it is necessary to increase precision of modeling which has to include thermal conductivity for large (thick) parts, especially influential at the initial stage of densification. This sounds obvious, but our analysis shows that rather than to work on constitutive equations and numerical procedures, it is more efficient to improve the material data base constituency and more particularly for the first step of HIP cycle which controls heat conductivity and the initial deformation pattern. In particular, it is shown that the initial (tap) density of powder in the capsule determines not only the integral shrinkage but also all following deformation pattern.
Independently of modeling, it is necessary to control all parameters generating scattering (HIP cycle, temperature homogeneity, filling and handling of capsules...) . The paper enables to define through parametric modeling which material properties, geometrical factors and process parameters are essential for reaching the dimensional precision and what realistic tolerances can be respected.

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Modellling

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