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# Prediction of the influence of non-homogeneous powder distribution on hot isostatically pressed components combining discrete element method and finite element analysis

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The non-uniform shrinkage of the tool/canister under hot isostatic pressing (HIP) condition is influenced by many factors, among which the powder relative density distribution seems to have a strong effect. Prediction of the final tool deformation is fundamental for canister design in order to meet dimensional tolerances of final component. To this end, numerical approaches represent a promising alternative to the expensive iterative experimental trials. Researches up to date are generally based on finite element analysis where a uniform powder relative density distribution is assigned over the whole mesh domain. In this study the Discrete Element Method (DEM) has been employed to simulate Ti-6Al-4V powder filling and pre-consolidation process allowing modelling the powder as single individual entities. A Finite Element Model (FEM) has been developed to simulate the HIP process, where the relative density distribution assigned to each element has been calculated from the final powder configuration obtained by DEM. Moreover, experimental work has been carried out validating the powder filling phase in terms of filling time, angle of repose of powder and powder relative density distribution, and the influence of the initial powder distribution on the tool shrinkage. Comparison between experimental and numerical results shows the capacity of the numerical method to predict the canister shrinkage and the results strongly suggest that it is necessary to take into account the inhomogeneous powder distribution inside the canister.

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