**CFD analyses of the gas flow inside the vessel of a hot isostatic press**

**ABSTRACT**

Hot isostatic pressing (HIP) is a thermal treatment method that is used to consolidate, density or bond components and materials. Argon gas is commonly used as the pressure medium and is isostatically applied to the material with an excess pressure of 500- 2000 bar and a temperature of 500-2200oC. With HIP treatment being a well-established technology for the last decades, one is now striving to obtain an increased understanding of local details in the internal gas flow and heat flux inside the HIP apparatus. The main objective of this work is to assess the potential of using computational fluid dynamics (CFD) as a reliable tool for future HIP development. Two simulations are being performed of which the first one is a steady- state analysis of a phase in the HIP-cycle called sustained state. The second simulation is a transient analysis, aiming to describe the cooling phase in the HIP-cycle. The most suitable modeling approaches are determined through testing and evaluation of methods, models, discretization schemes and other solver parameters. To validate the sustained state simulation, the solution is compared to measurements of operating pressure, heat dissipation rate out through the HIP vessel and local temperature by the vessel wall. However, no validation of the cooling simulations has been conducted. A sensitivity analysis was also performed, from which it could be established that a mesh refinement of strong temperature gradients resulted in an increase of wall heat dissipation rate by 1.8%. Both of the simulation models have shown to yield satisfactory solutions that are consistent with the reality. With the achieved results, CFD has now been introduced into the HIP field and the presented modeling methods may serve as guidelines for future simulations.