

# Capsule-free HIP of Water Atomised Steel Powder through CIP

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Water-atomised powder metallurgical (PM) steels offer cost-effective solutions for structural components and are typically processed through the 'press and sinter' route. Utilizing these steels for high performance applications requires further improvement of their mechanical performance. This requires increased density as compared to that achieved via the conventional uniaxial pressing and sintering route. The present study demonstrates the prospect of employing cold isostatic pressing (CIP) to achieve enhanced densification for iron and Cr-alloyed powder grades without using lubricant. It was shown that higher green densities can be achieved after CIP in comparison with uniaxial pressing for equivalent nominal pressures for both powder grades studied; with a gain of about 0.3 g/cm<sup>3</sup> obtained at 600 MPa. In addition, the homogeneous densification eliminates low-density (neutral) zone otherwise obtained in the centre of uniaxial compacted components with large height to diameter ratio. As a consequence, significantly larger components are supposed to be possible than by means of conventional press and sinter. The sintering of CIP compacts at 1250°C for 1 hour resulted in surface pore closure which enabled subsequent full densification using capsule-free HIP process. The results suggest that using cost-effective water atomised powder grades and eliminating the necessity of capsule for HIP offers the potential of realizing new PM products, in particular with regards to manufacture of medium-sized net-shape PM components.

Keywords: PM Steels, CIP, water atomised powders, capsule free HIP, full density

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Materials

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