

Hot Isostatic Pressing of the Water Atomized Steel Powder Prealloyed with Chromium

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Typically gas atomized powder grades are used for hot isostatic pressing. Gas atomization provides spherical powder with the high purity that is required for HIP. Water atomized steel powder is significantly cheaper but has some drawbacks when it comes to the powder purity, irregular powder surface, difficulty to produce high alloyed materials, etc.

Recent advancement in the water atomization allows manufacturing of iron and low-alloyed steel powder with the purity close to gas atomized powder from the surface oxide composition point of view. Hence, HIPing of industrially water atomized steel powder, prealloyed with 3 wt.% Cr and 0.5 wt.% Mo is performed in this study. Graphite powder is admixed to the base powder (0.4 wt.%) in order to achieve required steel composition and further HIPed as well. Oxide transformation in the system is discussed based on the initial powder surface oxide analysis and analysis of the fracture surface of the HIPed components. These are studied by X-ray photoelectron spectroscopy (XPS) and high-resolution scanning electron microscopy (HR SEM) combined with EDX. The mechanical properties of the HIPed material are evaluated and results are discussed with regard to the influence of residual surface oxides and microstructure. Full density components were obtained in case of both, pure powder and powder admixed with graphite. Mechanical properties were on the level expected for the fully dense material, indicating potential of HIPing of water atomized powder. Further efforts to improve powder filling are necessary to get full advantage of the HIPing of water atomized powders.

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Materials

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