

Overview of properties, features and developments of PM HIP 316L and 316LN

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PM HIP 316L is an alloy that is of increased interest for nuclear applications since it's recent ASME code case approval. Over the years comprehensive data and understanding of the properties and features have been collected and evaluated which will be summarised in this article. Since the early developments of the PM HIP technology it has been observed that PM HIP alloys generally exhibit higher yield strengths compared to their conventional counterparts, a feature that applies well for 316L. In this article this is demonstrated, both by using the Hall-Petch relationship as well as Pickering's and Irvine's empirically derived relationship between composition, grain size and yield strength for austenitic stainless steels. Furthermore, a mechanism generating the increased yield strength in PM HIP 316L vs conventionally manufactured 316L will be proposed. Results also show that low oxygen contents itself is not a guarantee for good or increased performance in form of mechanical properties, but that there are other features that is of similar or perhaps even higher importance in order to achieve good properties. The results of this article includes microstructural properties derived from EBSD measurements as well as tensile and impact properties in a wide range of test temperatures of PM HIP 316L from several powder batches manufactured at different locations and processed with various HIP and heat treatment procedures. Finally, some results regarding creep properties of PM HIP 316L is presented.

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Materials

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