Development of Dual Phase Steel for LPBF Applications

Kerri Horvay, Christopher Schade and Thomas Murphy
Hoeganaes Corporation
Cinnaminson, NJ

ABSTRACT

As additive manufacturing (AM) expands into the structural and automotive parts market more suitable materials need to become available that are tailored to these applications. For this study, a dual phase (DP) steel was chosen because of its combination of high strength and ductility. Its microstructure typically consists of two phases: islands of hard martensite and a soft ferrite matrix. Currently, DP steels are used in various automotive components that are produced by conventional manufacturing methods. The mechanical properties of laser powder bed fusion (LPBF) test specimens are evaluated as well as heat treated properties to show the range of properties that can be developed with a single alloy system. This provides greater flexibility to the end user by allowing one material to be utilized in a range of applications. Microstructures and porosity are evaluated for gas atomized powder and discussed in relation to the build parameters and the mechanical properties.

INTRODUCTION

Currently, there is a need for more materials to be qualified for use in different additive manufacturing processes. Thus, it is important to explore new material possibilities by investigating the potential of existing wrought alloys currently being used for serial production parts. Dual phase steels are widely used in the automotive market and are processed by traditional thermomechanical methods. This steel can be found in wheel rims as well as safety critical car components.[1] As compared with conventional steels, DP steels have superior formability which is beneficial to part fabrication, particularly in stamped autobody panels.

Components made from DP sheet metal are created from steel slabs that may go through various hot and cold rolling processes to reduce its thickness. Then the steel sheet is passed through a continuous annealing furnace at a high temperature to intercritically anneal into the ferrite-austenite region.[1] It is cooled rapidly to transform the austenite to typically 20% of a hard second phase (martensite) surrounded by a soft ferrite matrix. This results in a microstructure that provides high strength, good ductility, and a