A First Look at Oxide Dispersion Strengthened Copper for Laser Powder Bed Fusion

Miranda Vader, Nick Murphy, Tom Pelletiers, Joe Croteau
Kymera International
Durham, North Carolina

Abstract

The additive manufacturing industry is seeing an increasing demand for copper alloys in the space and defense markets. These are challenging applications where the selected material must maintain sufficient strength and conductivities at elevated temperatures. Oxide Dispersion Strengthened (ODS) Copper offers a solution due to its properties being derived from a fine dispersion of oxide particles that are minimally affected by high temperatures. Traditionally used in extruded form, Kymera has optimized powder feedstock to enable processing of ODS copper via laser powder bed fusion. Data such as powder characteristics, print parameter development, and material properties will be examined in this paper.

Introduction

The additive manufacturing industry is seeing an increasing demand for copper alloys to be used in highly demanding applications. Space and defense applications can be especially challenging, where materials must not only have high thermal conductivity and strength, but also maintain these properties at elevated temperatures.[1] While much work has been done to process pure copper using laser powder bed fusion, the low strength of copper is a serious detriment to many applications. The industry is starting to look at other alloys, such as C18150 (CuCrZr), and GRCop-42 (CuCrNb), to fill these gaps.[2]

GRCop-42, developed by NASA, has shown particularly outstanding results, and can meet the extreme demands of rocket engine combustion chambers. However, the alloy itself can be expensive and difficult to work with. The atomization of GRCop powder requires atomization in argon to prevent the formation of nitrides, very high melting temperatures to achieve an even dispersion of the niobium precipitates, and