Influence of Residual Carbon Content on Microstructure and Properties of Copper Produced by Binder Jet

John P. Reidy* and Animesh Bose[+]

*Desktop Metal, Inc.Burlington, MA

[+]Optimus Alloys, Durham, NC

ABSTRACT

Additive manufacturing (AM) of copper components is an exciting area of research, with potential applications in many spaces. Among AM methods, binder jetting is attractive for its high throughput. However, the binder used can leave behind residual carbon in the sintered copper component. In this work, copper parts produced by binder jet printing using a nominally pure copper powder were subjected to a variety of different debind and sintering cycles, resulting in two levels of residual carbon and a range of sintered densities. It was found that higher final carbon content led to a finer, less homogeneous microstructure as compared to the population with a lower final carbon content. Additionally, for the population with lower carbon content, pore coarsening was observed at the peak temperature utilized for the parts with higher carbon content. Several lower peak temperatures were investigated for the low carbon content population, resulting in higher sintered density When subjected to tensile testing, it was found that copper parts with high residual carbon levels exhibited much less ductility than those with low residual carbon.

INTRODUCTION

Copper remains among the most important industrial metals for its high electrical and thermal conductivity. Recently, additive manufacturing (AM) of copper has become of interest in electrical components and heat transfer applications, where the added design freedom allows improved efficiency and performance [1-7]. Such parts often either cannot be produced by traditional manufacturing methods or are prohibitively expensive to produce without AM. However, AM of copper has proved challenging. In laser powder bed