Material Properties and Shrinkage of 3D Printing Parts using Ultrafuse Stainless Steel 316LX Filament

Abstract. As a novel manufacturing methodology, 3D printing or additive manufacturing (AM) attracts much more attentions for complex structure fabrication, especially for manufacturing metal parts. A number of metal AM processes have been studied and commercialized. However, most of them are costly and less accessible. This paper introduces a material extrusion based 3D printing process for making austenitic stainless steel 316L part using a metal-polymer composite filament (Ultrafuse 316LX). The stainless steel 316L metal specimens are printed by a commonly used 3D printer loaded with Ultrafuse filament, followed by an industry standard debinding and sintering process. Tests are performed to understand the material properties, such as hardness, tensile strength, and microstructural characteristics, of the stainless steel 316L material. In addition, an artifact model is designed to estimate the part shrinkage after the debinding and sintering process. It is found that the stainless steel 316L part exhibits apparent shrinkage after sintering. But using the Ultrafuse filament for 3D printing could be an alternative way of making metal AM parts.