Preliminary Study on Machining of Additively Manufactured Ti-6Al-4V

Jay K. Raval[1], Aamer A. Kazi[1], Xiangyu Guo[1], Ryan Zvanut[2], Chabum Lee[1], Bruce L. Tai[1]

[1] Department of Mechanical Engineering, Texas A&M University, College Station, TX, 77840

[2] Kansas City National Security Campus, Honeywell FM&T, Kansas City, MO, 64147

Abstract

Additively manufactured metals differ from their conventionally produced counterparts due to the inherent material inhomogeneity, porosity, and thermal stress induced by the process. These differences make the machining of additively manufactured metals more difficult and cause premature tool failure or unexpected surface finish at certain conditions. This study takes the first step to investigate and identify the causes of these issues, particularly for Ti-6Al-4V. Printed and wrought samples, as well as heat treatment effect, are compared in a dry cutting condition at a cutting speed of 90 m/min in terms of cutting power, vibration, temperature, and produced surface finish. The results show a lower cutting power and more vibration for as-printed Ti samples, indicating a less ductile microstructure and inclusion of pores. Heat treatment can eliminate these phenomena. There is no significant difference found in the produced surface finish at the current cutting condition.

The full paper may be found in a special issue of the TMS publication *JOM*, March 2022.