SAND2022-3097C

High Pressure Response of Additively Manufactured AlSi10Mg

Paul E. Specht[1], Patricia Kalita[1], Kaleb Burrage[2], Jessie S. Smith[3], and Nathan P. Brown[1]

[1] Sandia National Laboratories, Albuquerque New Mexico 87185, USA

[2] University of Alabama Birmingham, Birmingham Alabama 35294, USA

[3] High-Pressure Collaborative Access Team, Argonne National Laboratory, Argonne Illinois 60439, USA

March 16, 2022

Additive manufacturing (AM) is a rapidly emerging technology with the potential to expedite current engineering design processes. However, the AM process does not always lend itself to traditional engineering alloys. Often, unique alloy compositions are used to improve the AM process. A common example is AlSi10Mg, which uses high Si content to lower its melting point, improve fluidity, and reduce thermal expansion. In this work, we present a synergistic study using shockless compression on Sandia National Laboratories' Z machine and structural x-ray diffraction (XRD) measurements at high-pressures in a diamond anvil cell (DAC) at the High Pressure Collaborative Access Team (HPCAT) on AM AlSi10Mg to quantify its high pressure thermodynamic response. We find that the pressure-induced phase transitions present in Si alter the bulk response of the AM AlSi10Mg alloy.

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525. Portions of this work were performed at HPCAT (Sector 16), Advanced Photon Source (APS), Argonne National Laboratory. HPCAT operations are supported by DOE-NNSA's Office of Experimental Sciences. The Advanced Photon Source is a U.S. Department of Energy (DOE) Office of Science User Facility operated for the DOE Office of Science by Argonne National Laboratory under Contract No. DE-AC02-06CH11357. This work describes objective technical results and analysis. Any subjective views or opinions that might be expressed in the work do not necessarily represent the views of the U.S. Department of Energy or the United States Government. KCB present address is: Oak Ridge National Laboratories, Oak Ridge, TN 37830