Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Properties of liquid Ti alloys from electrostatic levitation experiments and simulation[1] BRIAN NOVAK, Department of Mechanical and Industrial Engineering, Louisiana State University, Baton Rouge, LA 70803, JONATHAN RAUSH, Department of Mechanical Engineering, University of Louisiana at Lafayette, Lafayette, LA 70503, XIAOMAN ZHANG, DOREL MOLDOVAN, WENJIN MENG, SHENGMIN GUO, Department of Mechanical and Industrial Engineering, Louisiana State University, Baton Rouge, LA 70803 — Accurate thermophysical property data for liquid metals and alloys are important for the development of realistic simulations of laser-based 3D printing processes. We are using the container-less electrostatic levitation (ESL) method, molecular simulation, and CALPHAD calculations to obtain such data for Ti alloys. We performed vacuum ESL measurements of viscosity and surface tension with an oscillating drop technique at NASA MSFC on molten elemental Ti, Ti-xAl binaries (x = 0-10 wt%), Ti-6Al-4V, and Ti-6Al-4V-10Mo which showed improved mechanical properties compared with traditional β Ti alloys. We also used classical molecular simulations to obtain viscosities and surface tensions for Ti-xAl. Pair distribution functions, diffusivities, and vapor pressures were also obtained from simulations. The simulated viscosities and surface tensions for pure Ti agree well with the ESL data while the Ti-xAl viscosities have the same trends as the ESL data, but not quantitative agreement. Chemical activity and Gibbs free energy of Ti-10Al were generated using the CALPHAD technique and compared to experimental values.

[1]Supported by the National Science Foundation through cooperative agreement OIA-1541079 and the Louisiana Board of Regents.

Brian Novak
Louisiana State University

Date submitted: 16 Nov 2016 Electronic form version 1.4