Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

High Temperature Concentrated Solar Power Using Liquid Metal

ASEGUN HENRY, Georgia Institute of Technology — One of the most attractive ways to try and reduce the cost of concentrated solar power (CSP) is to increase the system efficiency and the biggest loss in the system occurs in the conversion of heat to electricity via heat engine. Heat engines that utilize turbomachinery currently operate near their thermodynamic limitations and thus one of the only ways to improve heat engine efficiency is to increase the turbine inlet temperature. Significant effort is being devoted to the development of supercritical CO2 heat engines, but the most efficient heat engines are combined cycles, which reach efficiencies as high as 60%. However, such heat engines require turbine inlet temperatures ˜1300-1500C, which is far beyond what is currently feasible with the state of the art molten salt infrastructure. In working towards the development of a system that can operate in the 1300-1500C temperature range, the most significant challenges lie in the materials and forming functional and reliable components out of new materials. One of the most attractive options from a cost and heat transfer perspective is to use liquid metals, such as tin and aluminum-silicon alloys along with a ceramic based infrastructure. This talk will overview ongoing efforts in the Atomistic Simulation and Energy (ASE) research group at Georgia Tech to develop prototype components such as an efficient high temperature cavity receiver, pumps and valves that can make a liquid metal based CSP infrastructure realizable.

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Date submitted: 01 Dec 2015 Electronic form version 1.4