Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

The influence of growth instability on oxide layers formation on FeCrAl-alloy during oxidation in high-temperature liquid heavy metals MIROSLAV POPOVIC, University of California -Berkeley, 3117 Etcheverry Hall, Berkeley, CA 94720, KAI CHEN, HAO SHEN, School of Materials Science and Engineering, Xi'an Jiaotong University 28 West Xianning Road, Xi'an, Shaanxi 710049, P. R. China, MARK ASTA, Department of Materials Science and Engineering, UC Berkeley, Berkeley, CA 94720, YUN YANG, PETER HOSEMANN, Department of Nuclear Engineering, UC Berkeley, Berkeley, CA 94720 — Oxidation of Fe-based alloys in liquid heavy metal environment, with low oxygen concentration in liquid phase, leads to formation of various oxide structures at solid-liquid interface. These structures are primarily determined by oxygen concentration and diffusivity of cations from solid to liquid phase and oxygen anion in reverse. In this work, the influence of temperature and oxygen concentration on oxides growth dynamics and their diffusion properties is examined in oxidation of FeCrAl-alloy in liquid lead-bismuth at high temperatures. The order of oxide phases, and their structure, revealed by XRD, EDS, TEM and Raman, are correlated with model predictions of dynamics of their formation and degradation. The roles of Fe-Cr-Al-O heterostructure and Al_2O_3 in enhancing diffusion and stabilizing oxide layers are examined. Results show that oxide growth stability is achievable only within a narrow range of oxygen concentration in liquid at particular temperatures, and leads to increase in Al_2O_3 phase. This enables a relationship between oxidation conditions, diffusion properties and oxide growth dynamics to be understood in quantitative terms.

Miroslav Popovic
University of California -Berkeley, 3117 Etcheverry Hall, Berkeley, CA 94709

Date submitted: 11 Nov 2016 Electronic form version 1.4