

8th International Conference on Physical and Numerical Simulation of Materials Processing (ICPNS)

14–17 October 2016

Seattle, Washington | Hosted by Purdue University

### SESSION 6: LIGHT ALLOYS, MARITIME HALL

Co-Chairs: Qigui Wang, General Motors Company Pontiac; Tongmin Wang, Dalian University of Technology; Jianxin Zhou, Huazhong University of Science and Technology; Lianxi Hu, Harbin Institute of Technology

**SATURDAY, OCTOBER 15, 2016**

---

## Temperature filed numerical simulation of laser welding for TA15 titanium alloy by coupling thermal and phase transformation

Wenmin Ou; Yanhong Wei; Xiaohong Zhan, Nanjing University of Aeronautics and Astronautics; Gaoyang Mi, Huazhong University of Science and Technology

### ABSTRACT

The phase fraction distribution and temperature are important factors to decide the material properties during welding and then affect the temperature field. A FEM model of TA15 laser welding is developed to simulate the temperature field considering the effect of coupled temperature and phase transformation. The phase transformation model of TA15 titanium is improved on the basis of JMAK equation. Furthermore, the linear interpolation method is employed to figure out the material properties in different temperature and phase fraction. The laser welding parameters for the model are obtained from the orthogonal experiments of TA15 titanium plates with 4 and 6 mm thickness, respectively. It is found that the peak temperature of its thermal cycle is about 2400°C, while it reduced to about 2000°C in the effect of coupled temperature and phase transformation during the heating process. The relative temperature error is 2.8% comparing with the commercial finite element software Simufact.welding. Based on the analysis of the simulation with coupled temperature and phase transformation model, different welding procedures can be optimized.

**KEYWORDS:** numerical simulation, temperature filed, phase transformation, TA15 titanium, laser welding