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A COMPARISON OF THE HEAT DISTRIBUTION ON TITANIUM ALLOYS MELTED IN NORMAL GRAVITY AND MILIGRAVITY CONDITIONS

Abstract

The following research is part of the REXUS/BEXUS programme, which is realised under a bilateral Agency Agreement between the German Aerospace Center (DLR) and the Swedish National Space Board (SNSB). The current analysis is part of one experiment that will fly on board of the REXUS sounding rocket in May 2014, from Kiruna, Sweden. As an overview, the setup of our payload consists of a 25W LASER diode that melts and welds Ti6Al4V samples in 120 seconds of miligravity. Specifically, an investigation of heat-affected zone of the sheets is performed, in terms of structure and distribution. The experiment is performed on board of the sounding rocket and on Earth-based laboratories. For a strong visualization and for solving potential structural issues, especially for the heat transfer and fluid dynamics, a Finite Element Analysis (FEA) technique was used. A Gaussian distribution of the heat affected zone was modelled. Moreover, it was observed that the high intensity laser processes have a smaller heat affected zone. We used a Scanning Electron Microscope (SEM) and a Transmission Electron Microscope (TEM) to determine and analyze the heat distribution and structure on titanium samples melted under Earth–based laboratory conditions. In conclustion, the analysis follows to understand the changes in microstructure and fulfills the need to understand how Titanium alloys solidifies in imponderability. In addition, it augments a wider research "Investigation of the surface deformation and dendritic solidification of different metals". Further examination in this direction is necessary, as a demand of the breakthroughts in space technology and material science.