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## POSSIBILITY OF TRANSFERRING WELDING TECHNOLOGIES TO EXTRATERRESTRIAL CONDITIONS

Welding is an important and widespread technological process for the production and repair of structures for various purposes. Most welding processes are based on using of different types of heat sources. When joining metallic materials in most cases the effects of the thermal cycle are present. In particular, thermal exposure leads to the formation of a heat affected zone (HAZ). HAZ is an area adjacent to the joint zone, in which changes in structure, mechanical properties, chemical composition due to heating and further cooling are observed [1]. Depending on the technology and technique of welding, thermal exposure leads to the formation of residual deformations and stresses. These also cause changes in the characteristics of the structural material. Depending on the operating conditions a local damage and failure of the structure as a whole may occur due to such changes [2].

To evaluate a possibility of direct transfer of welding technologies to extraterrestrial conditions a computer simulation was performed for three structures located in conditions of Earth, Moon and Mars with corresponding gravity and environment temperature. Material characteristics were set close to those of 2024 aluminum-based alloy. Heating source used in a model had a density ~  $10^5 \text{ W / cm}^2$  at a temperature of  $8000 \text{ }^\circ\text{C}$ , heat input was  $340 \text{ J / mm}$ .

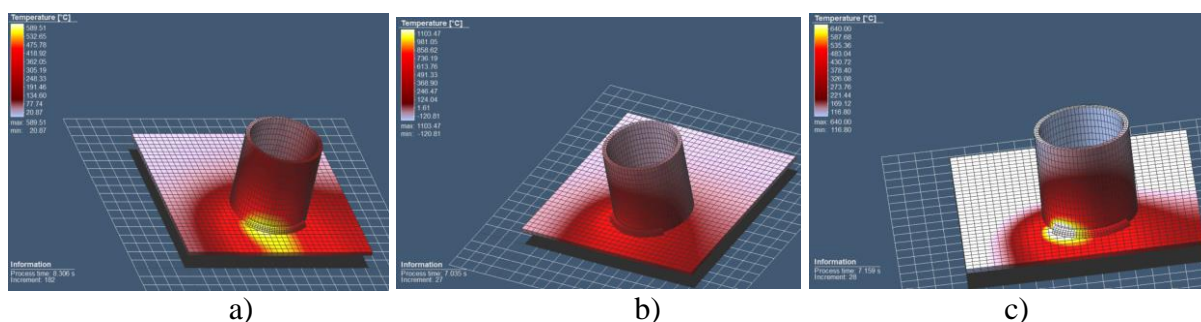


Fig. 1 – Results of simulation (end of welding): a – Earth; b – Mars; c - Moon

It was determined by analysis of temperature distribution across the structure after welding and after cooling that processes with such thermal cycle can be almost directly transferred to Moon conditions. In case of Mars the cooling speed is extremely high which leads to the need of using additional technological operations, especially in case of joining materials susceptible to quenching.

### References

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