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MANUFACTURING OF LARGE SCALE FRICTION STIR WELDED AND SPIN FORMED DOMES
WITH AN OPTIMIZED PROCESS CHAIN

Abstract

Due to their specific characteristics Friction Stir Welds can be used to weld aluminum alloys for a subsequent forming process. Within this paper the integration of the FSW process into the manufacturing sequence of spinformed domes of aluminum alloys for launcher cryogenic tank systems will be presented.

The special concave spinforming technology of MT Aerospace is used to produce net-shape parts by forming flat plates with a roller system to domes. If manufacturing large domes ($> 5,3$ m), the required raw material plates for spinforming are wider than currently available plates. A solution is to join two aluminium plates in order to reach the required diameter. Because of the high strain imposed by the spinforming process, the material within the weld zone must fulfill special requirements. In contrast to other welding processes the Friction Stir Welding approach leads to characteristics which allow the forming of the weld with high forming degrees under tension.

This paper describes the optimization of the process chain containing of Friction Stir Welding, thermal treatment and the spinforming process for the aluminum alloy AA2219. A special attention will be paid regarding the interactions between the particular processes. The investigations were mainly carried out on subscale level (1m). The findings were additionally evaluated at full scale application domes at 4m. The gained material properties will be presented as well as a potential transfer of the results to domes made of the Aluminum-Lithium-Alloy AA2195. As outlook the application of these domes within welded components will be described.