

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Advancements in Materials Applications and Rapid Prototyping (9)

Author: Dr. Qiang Zhou

Institute of Manned Space System Engineering, China Academy of Space Technology (CAST), China,
zhouq.dl@gmail.com

TENSILE PROPERTIES OF THE WELDING JOINTS: TESTS ON ALUMINUM ALLOY SPECIMEN
OF ROLLED AND FORGE PIECES

Abstract

Aluminum alloys are widely used on manned spacecraft. The tensile properties of the alloys are the key features to the design and operation of the crafts. In this study, a series of tests have been performed to investigate the effect on the tensile properties of the manufacturing process, for instance, the rolling and forging procedure. The metallographic analysis indicates the change of the microstructure within the alloy resulting in the tensile strength and extensibility in different orientations. The welding specimen, thin rolled plate-thin rolled plate, thin rolled plate-thick rolled plate, thin rolled plate-forge piece, thick rolled plate-forge piece, have shown similar tensile strength and extensibility. The welding procedure weakens the welding joints, which leads to the failure occurring in the welding joints rather than others. An analysis shows that the same microstructure within the welding joints results in the similar tensile strength and extensibility. Moreover the tensile properties decrease little after the welding procedure and tend to be a brittle behavior: the yield stage of the σ - ϵ relationship vanishes. This investigation indicates that the mechanical performance variations of Aluminum alloys caused by machining, rolling forge and welding must be concerned in the design of the spacecrafts.