

Residual Stress Effects and Mechanical Property of Dissimilar 2024-T3 and 7075-T6 FSW Joints

Yu E Ma^{1,2} Jiang Li¹

¹School of Aeronautics, Northwestern Polytechnical University

² State Key Laboratory for Strength and Vibration of Mechanical Structures, Xi'An JiaoTong University

Friction stir welding (FSW) technology can be used to reduce weight , improve the comprehensive performance and save cost , especially it can weld 2xxx and 7xxx aluminum alloys that can't be welded by the tradition welding way, so FSWed integral structure is potential to be one of aeronautical structure in the future. Some aircraft parts of dissimilar alloys need to be joined together to be one part. So this paper studied the distribution of residual stress, mechanical properties and fatigue crack growth properties of similar and dissimilar 2024-T3 and 7075-T6 thin friction stir welded plates.

Similar and dissimilar 2024-T3 and 7075-T6 plates were welded by proper friction stir welding parameters. And then X-ray diffraction method was used to measure residual stress profiles in welded plates. Residual stress profiles of the similar and dissimilar plates were compared and analyzed. Finite element models of similar and dissimilar welded plates were built by ABAQUS. The residual stress intensity factor profiles in different welded samples were calculated and compared. The effect of residual stress on fatigue parameter was simulated and quantified. Mechanical properties of FSWed joints and fatigue crack growth were measured. The numerical results were compared with the experimental ones.

Key words: friction stir welding; similar and dissimilar; residual stress; stress-strain curve; damage tolerance analysis