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Welding Technology Developments for Stringer-Skin Joints with Al-Li Alloys

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Abstract : Manufacturing aeronautic structures joining extruded profiles or stringers to sheets or skins of aluminium is a typical manufacturing procedure in aeronautic structures. Although riveting is the conventional manufacturing technology to produce such joints, the Friction Stir Welding (FSW) and Laser Beam Welding (LBW) technologies have also demonstrated their potential for this kind of applications. Therefore, FSW and LBW technologies have the potential to continue their development as manufacturing processes for aeronautic structures showing benefits such as time-saving, light-weighting and overall cost reduction. In addition to that, new aluminium-lithium based alloy developments represent great opportunities for advanced aeronautic structure manufacturing with potential benefits such as lightweight construction or improved corrosion resistance. This work presents the main approaches by FSW and LBW to develop those technologies to produce stiffened panel structures such as fuselage by stringer-skin joints and using innovative aluminium-lithium alloys. Initial welding tests were performed in AA2198-T3S aluminium alloys for LBW technology and with AA2198-T851 for FSW. Later tests for both FSW and LBW have been carried out using AA2099-T83 alloy extrusions as stringers and AA2060-T8E30 as skin materials. The weld quality and properties have been examined by metallographic analysis and mechanical testing, including shear tensile tests and pull-out tests. The analysis of the results have shown the relationships between processing conditions, micro-macrostructural properties and the mechanical strength of the welded joints. The effects produced in the different alloys investigated have been observed and particular weld formation mechanics have been studied for each material and welding technology. Therefore, relationships between welding conditions and the obtained weld properties for each material combination and welding technology will be discussed in this presentation.

Keywords : AA2060-T8E30, AA2099-T83, AA2198-T3S, AA2198-T851, friction stir welding, laser beam welding
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