The Effect of Pre-Straining on the Mechanical Behaviour of Self-Piercing Riveted Aluminium Alloy Sheets

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Abstract. Self-piercing riveting as an alternative joining method to spot-welding has attracted considerable interest from the automotive industry and has been widely used in aluminium intensive vehicles. Pressing and stamping are important processes in automotive production and result in additional straining on the vehicle body sheet material. It is therefore important to have knowledge of the effect of sheet pre-straining on the quality of the self-piercing riveted joints and on the mechanical behaviour of the riveted aluminium alloy sheets. This paper reports the influence of sheet pre-straining on the static and fatigue behaviour of self-piercing riveted aluminium alloy sheet. Wrought aluminium alloy sheet, NG5754 with a nominal thickness value of 2mm was used to obtain pre-strained NG5754 sheets with pre-straining levels of 3%, 5% and 10%. The pre-strained NG5754 sheets were then joined in pair to create single riveted lap joints. Lap-shear and fatigue tests were performed on the self-piercing riveted joints. Microscopic inspection showed that the joint quality was satisfactory despite the increasing sheet straining levels. The results showed that by increasing the pre-straining level up to 10%, the shear and fatigue strength also increased. The rate of increase of the static and fatigue strength differed as the pre-straining levels varied.