

Lightweighting Potential Of An Automotive Roof Reinforcement Using Different High Strength Steels And Aluminum Alloys

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Abstract. In recent years, weight reduction of vehicle parts has been a key priority for meeting the demand of reducing fuel consumption and environmental pollution while keeping passive safety needs. For that purpose, components made by hot stamped high strength steels are state of the art. On the other hand, the 6xxx and 7xxx aluminum alloy sheets are being studied due to their high specific strength and low density. However, the lightweighting capacity of the aluminum alloys in comparison to steels is not fully known yet.

In this work, in order to study the lightweighting aptitude of different aluminum alloys, a simplified real roof beam component thickness has been numerically optimized to reach the same flexural behaviour and energy absorption during a three point bending test. Besides AA7075-T6, AA6082-T6 and the AA6111-T6 high strength aluminum alloys, the often used DP1000 and USIBOR1500 high strength steels and a third generation FORTIFORM1050 steel have been included in the numerical study. As a result, the lightweighting potential of each material has been worked out and ranked.

Finally, the numerical results have been experimentally verified. The automotive roof reinforcements have been manufactured in all six materials using the numerical optimum thicknesses, followed by their corresponding post forming heat treatment. Aiming experimental validation, three point bending tests have been carried out and the results have been compared with the numerical results.