STUDY OF RESIDUAL STRESSES ON DP600 STEEL WELDED BY DIFFERENT PROCESSES

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ABSTRACT
The weight reduction and consequently fuel economy are extremely important factors for the automotive industry. The development of increasingly lighter vehicles has been achieved through the use of advanced high strength steels, such as Dual-Phase steels, whose microstructure consists mainly of ferrite and martensite and represent an excellent choice for applications where high tensile strength and high ductility are needed. Thus, this study is an evaluation of residual stresses, measured by X-rays diffraction technique, and microstructural analysis of autogenous welded joints by the different processes, comparing them with the base material. The residual stresses analysis showed the high tensile values in fusion zone in all samples.

Keywords: Dual-phase steel, LBW, PAW, GTAW, residual stresses, X-ray diffraction.

INTRODUCTION
As presented by among the guidelines for car developments, passive safety and fuel consumption are of paramount importance (Danyang Dong, 2014). Therefore, the use of advanced high strength steel (AHSS) is an effective solution for satisfying these needs. The unique combination of higher strength along with the larger elongation and higher work hardening rate of dual-phase (DP) steel, compared to the steel grades of similar yield strength, gave it better acquiescence to the automobile manufacturer (Bayraktar, 2004).

As the automobile industry has been applying new steels was necessary to search welding processes that could answer positively the most demanding specifications with increased productivity and quality. The welding process is closely linked to the development of residual stresses. Residual stresses (RS) appear as a material response to the heterogeneous distribution of non-uniform and permanent elastic or plastic deformations. These stresses are self-balanced, i.e., the resultant force and resultant moment produced by them is always zero (Pedrosa, 2000).

Thus, this paper presents a study about the influence of welding parameters on the final state of residual stresses in DP600 steel joints welded by different processes: GTAW (Gas Tungsten Arc Welding), LBW (Laser Beam Welding) and PAW (Plasma Arc Welding).

RESULTS AND CONCLUSIONS
Fig. 1 shows the residual stresses in the transversal direction on the top of welded joints. Significantly higher tensile RS values were observed in the fusion zone (FZ) in all samples.
This tendency is related to the restriction factor of contraction during the cooling of the samples in the welding process. On the other hand, in the heat affected zone (HAZ), automatic welding processes results in compressive residual stresses.

![Graph showing residual stresses](image)

**Fig. 1 - Residual stress after welding on the top of the samples.**

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**REFERENCES**

