

**Politechnika Śląska**

**Wydział Transportu i Inżynierii Lotniczej**

**Katedra Transportu Drogowego**



**ROZPRAWA DOKTORSKA**

***Wpływ chłodzenia mikrojetowego na właściwości eksploatacyjne spawanych konstrukcji nośnych pojazdów***

Promotor:

*prof. dr hab. inż. Tomasz Węgrzyn*

Doktorant:

*mgr inż. Tomasz Śliwiński*

## **Abstract**

This research paper examines issues related to the use of welding procedures combined with microjet cooling in the construction and repair of vehicle superstructures made of low-alloy steels and high-strength AHSS.

The conducted literature review constituted the basis on which the status of the issue was described. Vehicle superstructure classifications were approximated, the stresses in them were described, and the requirements for welding processes used in fabrication and repair were detailed. Steels used in vehicle superstructures were reviewed, with consideration given to unalloyed steel and AHSS. Also, a presentation of the welding thermal cycle and issues related to the weldability of steels were included. This was followed by a review of welding methods used in repairing and constructing vehicle superstructures and outlining the economic aspects of repairs. Microjet cooling application in welding and its influence on the structure and mechanical properties of the obtained joints were discussed.

Based on a literature review, a selection of welding process parameters were established and microjet cooling parameters used for preliminary tests was conducted, and the welding station, where homogeneous joints of unalloyed steel and homogeneous joints of DOCOL 1200 steel belonging to the AHSS steel group were made, was constructed. The obtained joints were subjected to selection according to the results of non-destructive testing (VT and MT). From the selected connectors, the samples and specimens were prepared to enable testing of mechanical properties. The ad hoc tensile strength and hardness distribution were determined; the casts were subjected to metallographic studies to determine the structure of the joints of non-alloy steels and AHSS. The aforementioned works allowed to determine the best welding process parameters along with microjet cooling. The determined process parameters were then applied in the core research.

Results of preliminary research and literature review constituted the basis for the proposed thesis of this research paper, which assumes that microjet cooling would improve the mechanical properties of welded joints used in the construction of vehicle bodies made of unalloyed steel and AHSS, and the most important criterion for determining this improvement would be the results of fatigue tests.

Fundamental testing started by performing radiographic tests, the aim of which was to check the propriety of the joints. This was followed by a bending test, an impact test and the determination of fatigue strength for both grades of steel under examination. The outcomes of all conducted mechanical tests were very positive. Joints made from unalloyed steel and made from AHSS showed better mechanical properties than joints made without microjet cooling. For additional inspection of the joints made of both tested materials, the form of non-metallic inclusions was analyzed under a scanning microscope. The aim of this research paper was achieved, and the thesis was confirmed.