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Advanced, non-destructive technologies to improve steel stir welding process through AI and smart digital twin



STWIN aims to develop a *flexible friction stir welding (FSW)* system capable of automatically fabricating complex 3D structures, including diverse joint configurations between steels of dissimilar grades and thicknesses, enabled by AI-based real-time monitoring system.

OBJ1. Real-Time Quality Monitoring for FSW
Within STWIN, a novel real-time monitoring system will be developed and demonstrated. The system will integrate key process parameters with complementary data obtained through a combination of sensors.

OBJ2. Development of AI models and a Digital Twin
STWIN will develop a digital twin for friction stir welding (FSW), supported by Machine Learning models. This framework will enable real-time process analysis, predictive capabilities and data-driven optimisation.

OBJ3. Manufacturing Process Optimisation
STWIN will evaluate and further enhance FSW tools for steel welding applications. New tool geometries will be designed and assessed to optimise joint performance, mechanical properties and tool lifespan.

OBJ4. Demonstration and Industrial Validation
To validate the developed methodology at industrial scale, STWIN includes a strong demonstration component comprising three case studies: (i) joining of high-strength steels for crane applications, (ii) welding of complex geometries and dissimilar materials for the automotive sector and (iii) joining of aluminium to steel for trailer applications.

€ 3,5M
BUDGET

45 MONTHS
DURATION

10
PARTNERS

6
COUNTRIES

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