

PROSPECTS 5.0 Industry 5.0 Wiki

Machinery and Metalworking Industry – FSW in
the Age of Industry 5.0

Date	: 26.09.2024
Task	: Task 5.2
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Machinery and Metalworking Industry–FSW in the Age of Industry 5.0

Machinery and Metalworking Industry–FSW

The sector designation falls into the area of mechanical engineering and metal processing industry, more precisely machines for friction stir welding (FSW) are built. High-tech welding solutions are offered and are mainly used in the automotive sector, but also in the aerospace and energy industries. The difficulty lies in the fact that it is a very specific area and requires a great deal of expertise to produce such special welds. These are supplied to customers from all over the world, which also makes transport difficult. Furthermore, a very high level of accuracy must be guaranteed, as it is a matter of millimetres and therefore safety.

The principles of Industry 5.0 **“human centricity, sustainability, and resilience”** are being progressively adopted in the mechanical engineering and metal processing industry, particularly in specialized fields like FSW.

The FSW process itself contributes to sustainability as it is an energy-efficient method that produces minimal waste compared to traditional welding techniques. In industries like automotive and aerospace, where lightweight, high-strength materials are essential, FSW helps produce joints that require less energy to manufacture and maintain, reducing overall material consumption. Additionally, by producing stronger, more durable joints, FSW extends the lifespan of components, aligning with circular economy principles. Some companies are also adopting more eco-friendly materials and exploring ways to make production and transport more energy-efficient, reducing their carbon footprint.

If you compare it to a practical example like arc welding, it not only consumes less energy but also has no toxic fumes or metal particles in the air so it's good for your health. Which is the most important point. Also its beneficial for the eyes. Which brings us to the next topic of human centricity. Within the FSW sector, there is a growing emphasis on human-centric design in both product development and operational practices. For example, automated FSW machines are designed with user-friendly interfaces and advanced sensors, allowing for collaboration between humans and machines. These technologies not only enhance productivity but also focus on worker safety and reducing the physical strain of manual welding tasks. By improving ergonomic factors and making complex processes more accessible, companies in the sector are aligning with the Industry 5.0 goal of empowering human workers.

To ensure resiliency in a sector that requires precision (down to millimetres) and global logistics, innovations in digital monitoring and predictive maintenance are becoming key. Smart sensors and real-time analytics integrated into FSW machines allow companies to monitor performance, reducing downtime and improving the accuracy of production. By maintaining high-quality standards through advanced automation, businesses can respond better to supply chain disruptions and continue to meet the demands of customers worldwide.

The future of the engineering and metalworking industries, and FSW in particular, looks promising with the increasing adoption of Industry 5.0 principles. As sustainability becomes a focus, the energy-efficient and low-waste process of FSW is likely to become increasingly important in sectors such as aerospace and energy, especially automotive. Stakeholders

should continue to invest in green innovations, such as using sustainable materials and optimising transportation to minimise environmental impact, as well as monitoring and real time analysis solutions.

The increased use of FSW machines can also improve the health and attractiveness of employees. What's more, they are fully automatic and not physically strenuous. Emphasis on worker training in these advanced technologies will also be critical.



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