



## Arc-Enhanced Friction Stir Welding

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**WARF: P05041US**

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**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method of pre-heating and softening a workpiece with an arc prior to welding to significantly reduce tool wear during friction stir welding of hard materials such as steels, titanium alloys and metal-matrix composites.**

### Overview

In friction stir welding (FSW), a rotating, cylindrical tool with a pin on its end is slowly plunged into a workpiece and moved along the joint to be welded. As the tool rotates, it generates frictional heat between the tool and the workpiece, causing the latter to soften, or become plastic. The softened material is transferred from the leading to the trailing edge of the pin, where it consolidates to form a solid-phase bond along the joint.

FSW has been used worldwide to weld soft materials, such as aluminum and magnesium alloys. But the rotating tool wears very quickly when FSW is applied to harder substances, making the technique unsuitable for welding materials such as steels, stainless steels, titanium alloys and metal-matrix composites.

### The Invention

A UW-Madison materials expert has now shown that pre-heating and softening a workpiece with an arc prior to welding can significantly reduce tool wear during friction stir welding of hard materials such as steels, titanium alloys and metal-matrix composites. Arc pre-heating prior to FSW can also join materials with very different physical properties, such as aluminum and copper, or aluminum and steel, something that is difficult to do with conventional FSW.

### Applications

- Friction stir welding of hard materials like steels or metals with dissimilar physical properties
- Welding in aerospace, automotive, railway manufacturing and shipbuilding industries

### Key Benefits

- Extends friction stir welding (FSW) to harder materials such as steels, stainless steels, titanium alloys and metal-matrix composites
- Arc pre-heating, which can be done with an ordinary gas-tungsten arc welding (TIG) machine, is simple and much less expensive than laser pre-heating.
- Can be used to join metals with very different physical properties (e.g., different melting points)

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#### For More Information About the Invention

- [Sindo Kou](#)

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## Tech Fields

- [Materials & Chemicals : Metals](#)

For current licensing status, please contact Michael Carey at [mcarey@warf.org](mailto:mcarey@warf.org) or 608-960-9867

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