Portable Friction Stir Welder

U.S. Navy photo

Taking an ideal joining technology right to where it is needed

Concurrent Technologies Corporation (CTC) is developing an innovative solution for repair and construction of U.S. Navy ships that is not available anywhere else. While friction stir welding (FSW) is ideally suited for repair of cracks in 5xxx series aluminum, no commercially available FSW systems can be used shipboard or in situ to perform weld repairs.

CTC's patented portable friction stir welder (PFSW) and process parameters are designed to weld inserts into ¼-inch thick sensitized 5xxx series aluminum panels. CTC's technology can be used for replacing sensitized and cracked material during ship repair, avoiding costly labor and schedule delays. In addition, CTC's PFSW technology could be used during new construction (for example, in deck socket installation and hull erection joints).

Uniquely Beneficial for the U.S. Navy

The use of 5xxx series aluminum is essential for reaching the design performance required for several classes of U.S. Navy ships. However, after several years of exposure to elevated in-service temperatures, 5xxx series aluminum can become sensitized. Sensitized aluminum is highly susceptible to pitting and stress corrosion cracking, and the high levels of sensitization encountered on these ships renders the material mostly unweldable by conventional means. As a result, costly and time-consuming repairs are required to replace the affected panels.

CTC Concurrent Technologies Corporation

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Why Portable Friction Stir Welding?

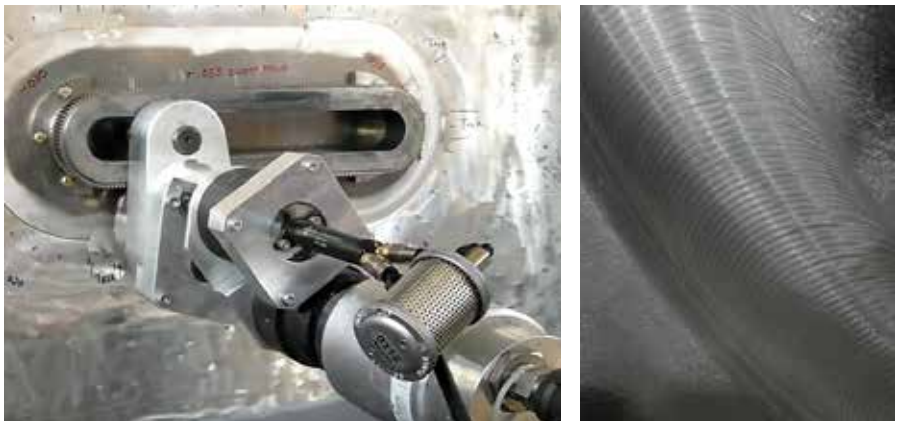
Large, stationary friction stir welders are used in some new ship construction applications where the work piece must be taken to the machine. Due to their size and weight, conventional friction stir welders cannot be utilized shipboard where many operations would benefit from the technology. CTC's PFSW is being developed to bring the full advantages of the friction stir welding to the repair site:

- quality welds in highly sensitized material
- less distortion/residual stress due to less heat input
- highly repeatable weld quality
- stronger welds due to stirring and refining of material grains
- no shielding gas required since not melting material
- no filler required since self-generated
- does not require highly skilled welders
- production-friendly

Portable friction stir welder on ship

How the Portable Friction Stir Welder Works

CTC's PFSW consists of a weld head, track, control hardware, and data acquisition to record and display process parameters. These components are hand carried and assembled shipboard. Air motors are used to drive the weld head and power the spindle. CTC's FSW technology can be used for welding inserts of varying size and shape, as well as welding straight erection joints. CTC's PFSW was used to perform panel repair on a U.S. Navy Guided-Missile Cruiser (USS Vicksburg CG-69).



PFSW being used shipboard on bulkhead (L), close up of typical weld (R).

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