ALUMINUM

Project Fact Sheet

Brazing and Spot Welding Innovations For Joining Aluminum Alloys

Benefits

Saves energy by providing for increased use of lightweight aluminum, which due to its high mechanical strength and corrosion resistance requires less energy for production than conventional engineering materials.

The spot-welding method offers manufacturers:

- More fatigue-resistant welds
- No special handling issues as with adhesive spot-welding.

The braze-joining method is:

- Less complicated than multistep cladding
- Much less costly than cladding.

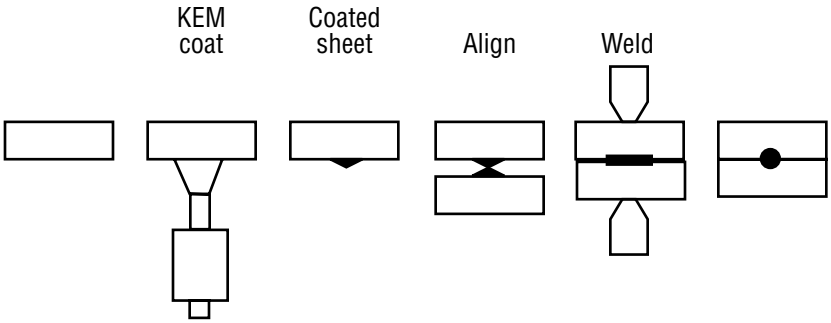
Applications

The technology will have immediate applications with bonding aluminum in various end-use industries, including the automotive and heat exchanger industries. The brazing and spot-welding potential of the technology could replace technologies now in operation, making the use of aluminum less problematic overall.

A new, two-part technology strengthens aluminum spot welds in the auto and heat exchanger industries

A new technology for brazing and spot welding makes use of localized solute addition (LSA) and a closely related process, kinetic energy metallization, to create simple, effective aluminum bonds. One of the most important problems identified by the Partnership for a New Generation of Vehicles (PNGV) with using aluminum in the automobile industry is the complexity of aluminum joining technologies. There are two common methods used in industry today for dealing with this issue: adhesive spot welding and cladding. The new technology achieves the same benefits provided by conventional spot welding, but at a lower cost and with less complexity.

Schematic Representation of LSA Process



The kinetic energy metallization (KEM) process can be used to effect two types of bonding for aluminum and aluminum alloys.

Project Description

Goal: The project goals were to improve and modify the technology to make it more efficient and to prepare it for commercialization.

The technology is an improvement over current forms of aluminum spot welding because it adds a strengthening agent to enhance mechanical-fatigue limits. This process alters the chemical composition of a weld without having to alter the composition of the alloy. Kinetic energy metallization uses a two-phase nozzle to accelerate metal particles into a substrate and applies the particles to the metal surface to be joined. It is a low-temperature, inert-gas procedure, so the composition of the substrate is not altered, avoiding contamination and negative effects on material properties, as well as eliminating the need for surface pretreatment.

Kinetic energy metallization is simpler and less expensive to implement than alternative methods used in spot welding. It produces a weld that has a fatigue limit matching that of the parent material, giving it an advantage over other spot-welding techniques. It also bypasses many of the difficult issues relevant to adhesive bonding, including the environmental issues surrounding the adhesive itself. In addition, as a replacement for cladding in heat exchangers, it allows for a brazing process that coats heat exchanger parts, such as microtubes, at a much lower cost than cladding.

Dr. Ralph Tapphorn developed this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- The technology has been fully developed and is covered by a patent.
- The technology is in an "enhanced development" stage where efficiency improve- ments and modifications are being made to perfect the technology. This phase will continue for 3 to 5 years, at which point it is expected to be market ready.

Economics and Commercial Potential

The technology will enhance the use of aluminum in various end-use industries, including the automobile and heat exchanger industries, where lightweight metals with high mechanical strength and corrosion resistance are likely to gain preference in the future based on their ability to reduce the energy required for production.

Industry of the Future—Aluminum

Through OIT's Industries of the Future initiative, the Aluminum Association, Inc., on behalf of the aluminum industry, has partnered with the U.S. Department of Energy (DOE) to spur technological innovations that will reduce energy consumption, pollution, and production costs. In March 1996, the industry outlined its vision for maintaining and building its competitive position in the world market in the document, ***Aluminum Industry: Industry/Government Partnerships for the Future****.*

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The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

Project Partners

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