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Cladding Pipe Proves Cost-Effective

Companies are increasingly using weld overlaid carbon steel components to avoid the cost of solid alloy.

The Quebec, Canada company Brospec 2001 LP., for example, recently delivered 133 sections of stainless steel weld-overlaid carbon steel pipe, tees, reducers and flanges to an acid plant. The carbon steel pieces were overlaid with a two-pass weld overlay using W30938 (39MoL) and W31637 (316L) on their inside surfaces to handle the corrosive conditions created by the presence of hydrogen sulphide.

Brospec started with a 3 millimetre (mm) thick layer of W30938, layed down circumferentially with 2.4 mm diameter flux cored wire AWS class E309LTMoT0-3, using an open arc welding process (self-shielded Flux Cored Arc Welding).

This layer acts as a buffer layer to prevent dilution of the final weld pass with the base metal.

The final layer consisted of 3 mm of W31637, laid down with 2.4 mm diameter flux cored wire AWS class E316LT0-3.

A total of 3,764 kilograms of W30938 welding wire and 4,000 kg of W31637 welding wire was used.

The resulting weld overlay deposit can handle the corrosivity of the process conditions and is a cost-effective way to produce 316L clad pipe.

MORE INFORMATION:
www.nickelmagazine.org/cladding

Foam that Remembers

Surprising scientific research results suggest new shape memory applications

Researchers in the U.S. claim they have come up with a less expensive, faster and more energy-efficient way to make shape memory alloys by carving out extra space between individual crystals.

The breakthrough, shared by foam experts at Northwestern University and shape memory experts at Boise State University, converts a nickel-manganese-gallium alloy into a foam that changes shape when exposed to a magnetic field, then pops back into its original form when the field is reversed.

The foam could be used to replace a complicated machine with a much simpler design using fewer parts, improve the efficacy of tiny motion control devices, or better control the emissions from combustion engines by speeding up the motion of the valves.

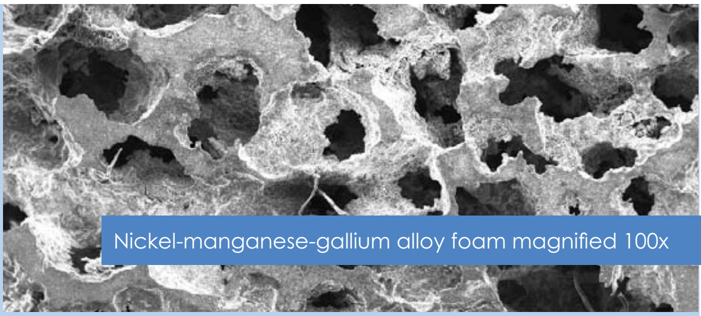
"European car manufacturers are looking into developing valves with a mechanism based on magnetic shape memory alloys," says Professor Peter Müllner of Boise State University. "In this application, the speed of action is critical."

One of the key advantages of magnetic shape memory alloys over those driven by temperature is faster response time. Another is their ability to be activated from a distance, making them potentially useful for biomedical applications: opening up an artery with a stent, for instance.

But so far, these materials have been functional only as single crystals, which are expensive and tricky to grow.

So the Northwestern-Boise team set out to create a material that approximated the excellent deformation properties of a nickel-manganese-gallium crystal, without the expense, time and energy consumption required to produce crystals individually.

To achieve this goal, Professor David Dunand and Dr. Yuttanant Boonyongmaneerat at Northwestern's Materials Science and Engineering Department poured molten nickel-manganese-gallium into a porous compact of sodium aluminate powders. Nickel constituted more than half the molten material. After the metal solidified, they leached out the oxide in acid, leaving behind large voids in the alloy.



Nickel-manganese-gallium alloy foam magnified 100x

BOISE STATE UNIVERSITY

The resulting metal foam looks like a piece of sponge toffee, allowing space for the individual crystals to move. In a typical polycrystalline metal, the crystals would stretch along different directions in the presence of a magnetic field, cancelling out each other's motion.

When Müllner and graduate student Markus Chmielus exposed the foam to a magnetic field, they found it deformed 0.12% — not nearly as much as a single crystal would but still cause for celebration since this range of deformation is sixty times greater than what had been observed in a polycrystal before.

"The results will trigger new research directions with industrial relevance," says Müllner.

The main competitor for the new metal foam is Terfenol D, another ferromagnetic alloy that was developed for military sonar devices. It converts magnetic field to mechanical power but has a maximum deformation of about 0.12%. If Dunand and Müllner could better this by tinkering with their new foam, they might provide a lighter, less expansive and more effective alternative in applications such as actuators and magneto-mechanical sensors.

MORE INFORMATION:
www.nickelmagazine.org/shapememory