

Powder Epoxy Provides Protection

Introducing metal into a water environment is nearly always a losing proposition. Unprotected metals placed in water quickly succumb to chemical attack, galvanic corrosion, or physical erosion. Because of this, any industry that uses water in its manufacturing process has to face the fact that the failure of the coatings used to protect critical valves, pipes, and meters can quickly result in this equipment being reduced to worthless piles of scale. Coating failures are especially devastating to metering systems that are required to accurately monitor municipal water supplies, measure industrial plant water consumption, or regulate the amount of water used by irrigation systems. When these systems fail, process control is lost, the ability to track valuable stock is reduced, and maintenance and overhead costs are increased.

As a result, most manufacturers rely on liquid epoxy coatings to protect their instruments from corrosion. For the most part, these epoxies consist of two components that, when mixed together, cross-link and cure to create a very tough, hard coating that is normally sprayed on. However, spray-applied liquid coatings often can't be applied to the relatively small, complex shapes of meter bodies in the thickness that will guarantee long-term protection. To overcome this problem, 3M has developed fluidized bed, fusion-bonded epoxy, a high-build powder coating that can be applied to irregular shapes.

"In creating this material, we start a chemical reaction that the manufacturer finishes off as part of the coating application," said 3M's National Sales Manager, Al Schupbach. "First, we take all the components for the epoxy and blend them together under heat and pressure. Then, to stop the reaction, the epoxy is extruded onto cooled sheets. Finally, it's broken up with knives and ground into a very fine powder suitable for use in the fluidized bed process."

Water Specialties Corporation used this coating technology to protect their meters from corrosion damage. "Even though epoxies have been used for decades, the fluidized bed process is newer and not as well known—there are very few companies that can do it," said Steve Huth, Water Specialties President. "We originally purchased a small fluidized bed operation and moved it to our plant in Porterville; however, most of the equipment we use now was de-

veloped in house with the help of 3M."

The fluidized bed used by Water Specialties consists of a vessel that contains two chambers separated by a horizontal porous plate. Refrigerated air is introduced below the plate and the powdered epoxy is suspended in the top chamber above the plate. Under low pressure, the air passes through the plate and bubbles up



3M's fusion-bonded epoxy was applied to Water Specialties' Ultra Mag magnetic flowmeter.

through the powder, "fluidizing" it so it looks like a pot of bubbling, swirling liquid.

The parts are immersed in the fluidized powder after being grit blasted to a near white metal finish and pre-heated to between 400°F and 450°F. When the fluidized powder comes into contact with the hot metal, it kicks off a reaction in the epoxy that causes it to liquefy, encapsulate, and fuse to the part. "The epoxy heat fuses onto the steel to provide an intimate bond with the metal that resists disbonding in corrosive environments," explained Schupbach. "The fusion bonding process also lends itself to the coverage of edges, complex corners, and shapes that would be difficult to cover uniformly with a liquid material."

Being a magmeter, Water Specialties' Ultra Mag flow tube is completely free of obstructions. However, since the magmeter requires an induced magnetic current for its operation, the internal coating has to be completely non-con-

ductive in order to eliminate stray currents. "If you look through a magmeter, it just looks like a smooth spool of pipe," commented Huth. "It's a very good meter where there is a lot of debris in the line, like in wastewater treatment facilities or for industrial process fluids and sludge." Magmeters are often protected with hard rubber coatings or Teflon liners. However, grit blasting tests have shown that fusion bonded epoxy has greater abrasion resistance than hard rubber, and it can't collapse when used on suction lines like Teflon liners can. "There are other methods of applying coatings, but they can't reliably achieve the 15 mil thickness we need for our prop meters, much less the 50 mils we want for our magmeters," said Huth. "We started applying this to our magmeters because of its outstanding electrical properties in addition to its corrosion and abrasion resistance."

To assure coating integrity, Water Specialties implements a stringent testing program. Testing methods include using magnetic pull off gauges and ultrasonic testers, rubbing the coating with a solvent like MEK to see if it softens, and spark testing the coating at 100 volts per mil of coating thickness.

In addition to the testing, Water Specialties was able to ascertain the effectiveness of the epoxy on site when the operators of a local irrigation system agreed to try fusion bonded epoxy to improve the reliability of their pumping equipment. "The irrigation system in Tehachapi California uses 12-inch and 18-inch vertical turbines to pump irrigation water that is contaminated with sand. Due to turbulence, and the abrasive nature of the sand in the water, their pump impellers had to be replaced every two years," said Huth. "We applied a fusion bonded coating to these impellers and after three years of service, the impellers were inspected and showed no appreciable wear."

In the face of the increasingly restrictive government regulation of paint-related emissions, fluidized bed fusion bonded epoxy is an environmentally responsible coating option. No solvents are involved in the process, and since the coating is 100 percent epoxy solids, no unpleasant fumes and no VOCs are released into the atmosphere. In addition, the coating has received National Sanitation Foundation (NSF) approval for use with potable water. **FC**