NEW CHEMISTRY FOR MOLD PLATING

Imagine discovering a process that you believe solves the mold repair problem of parts coming out too large. Wouldn't you want to share it with molders and toolmakers everywhere? That's what Berl Stein is trying to do, plant by plant. Stein, president and founder of NiCoForm Inc. in Rochester, NY, used his chemical engineering background to formulate a heavy plating method using nickel-cobalt alloys (called NiColoy), which he says are much stronger than straight nickel.

"I got involved in electroforming and started playing around with nickel-cobalt alloys because of their strength," he recalls. Since May 1999, when he started NiCoForm, Stein has persistently pursued molders and moldmakers with his electroforming process, targeting molds that require plating of .001 inch thick or greater.

Flanges of these H-13 sleeves have been plated with .020 inch of NiColoy nickel-cobalt alloy. The addition of cobalt significantly strengthens the coating, according to the alloy's inventor, Berl Stein.

Overcoming Obstacles

His toughest challenge has been overcoming the apprehension of molders who have had negative experiences with platers. However, Stein's firm belief in NiColoy motivated him to offer his services at no cost for an initial plating in some instances. Fred Grabbatin, toolroom group leader at Westplex Industries Corp. (Manchester, NY), a member of the Foster Group of Cos. and a custom molder that does its own mold repair, refused the free ride but did try the plating method, thanks mostly to Stein's persistence.

"We're very leery here because we have an established supplier base, so we tried him out with a couple of small things," says Grabbatin. "The results have exceeded our expectations."

Steve Bartz, tooling manager for local molder and moldmaker Alliance Precision Plastics, another NiCoForm customer, echoes this initial hesitation. "People had warned me about plating, and I did have problems with chrome or other plating flaking off," he relates, "but when using his process with every other kind of steel besides bronze, I haven't had a lick of trouble."

How It Works

Stein's electroforming process begins in a tank filled with a solution of nickel and cobalt salt. Bars of nickel and cobalt hang in the tank, serving as anodes to keep the solution in balance. An electrical current passes through the solution, causing atoms from each element to form a metal layer on the parts being plated. So that only the area to be coated is exposed, parts up to 20 by 30 inches are masked by hand with a waxlike material prior to being immersed in the solution, and then sit unattended until the plating is complete—anywhere from an hour to three days.

Because the process does not melt metal, like welding does, but rather converts the metal electrochemically into atoms and then converts it back into a metallic form on the part's surface, the newly formed layer has a smooth, uniform thickness, says Stein. His claim is supported by Grabbatin and Bartz; Alliance has found that spending more on electroforming saves time and money compared to welding.

"Cleanup time after the plating process is a lot faster than the cleanup time after welding," says Bartz. "Granted, it's a little more expensive, but we've come to the conclusion that it's still better. Instead of putting on a big blot of

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ELECTROFORMING CHECKLIST

Stein offers the following questions to prepare the molder or moldmaker prior to sending a mold component for repairs:

- What is the tool part made of?
- Was it hardened?
- Was it previously plated or welded?
- Define the exact outline of the area to be plated.
- How thick should the plated layer be?
- Should the deposit be heavier than required for postmachining or exactly the right thickness?
- How hard should the plated layer be?
- Does it have to be bright and uniform, or will it be postmachined?
- Is overplating on the sides required so the sharp edges can be restored?
- What turnaround time is required?
- What resin runs in the mold and at what temperature?
- How many identical parts will be sent for plating?

TABLE 1. COMMON METAL DEPOSITS USED FOR MOLD REPAIR

Metal	Plating rate, inch/hr/side	Hardness, Rockwell C	Appearance	Plating uniformity/ ability to plate in recesses	Postplating machining required
Nickel (soft)	≤ .005	≤ 20	matte gray	average	yes
Nickel (hard)	≤ .005	≤ 45	semibright	average	yes
Electroless nickel	≤ .001	≤ 70 (baked)	semibright to bright	good	no
Chromium (hard)	≤ .002	≤ 70	milky white, matte	poor	yes
Nickel cobalt	≤ .005	≤ 55	semibright to bright	above average	sometimes

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weld and having to clean that up, I can have .006- or .007-inch plating put on for a required .005-inch thickness, and have minimum cleanup afterwards."

Grabbatin concurs. "Ninety percent of the time with [NiColoy] plating we do a little handwork to blend it in. That's it." He says manual labor has been cut 50 to 75 percent since switching from welding.

The cost of Stein's electroforming varies with the complexity of the part to be plated, but he estimates that it's about 50 percent more than welding. For example, he says, a simple 4-by-4-inch part that needs to be plated to a thickness of .010 inch would cost a mold shop about $200 to $300.

While he stands behind his product, Stein advocates using the right plating method for the right situation. Using electroless nickel (up to .001 inch thick) is a better option for narrow, deep recesses, for instance, while nickel cobalt is more efficient for thicker plating. Table 1 compares properties of different plating materials.

Adhesion

Some of Stein's first experiences plating with nickel cobalt illustrate the growing pains of new chemistry. In one case, Grabbatin relates that some cores that NiCoForm electroformed shed the plating on initial runs. With Westplex facing downtime and the possibility of incurring financial penalties from its automotive customer, Stein worked on a Saturday to perfect his pretreatment process. This proved to be the source of trouble, and with a fix in place the glass-filled acetal parts were running again by the next day. Grabbatin says that the S-7 cores, which were plated a year ago, show no signs of wear or dimensional changes. Previous nickel plating didn't last three months, he notes.

Although he still is not able to plate onto bronze, Stein has a proven track record with steels such as P-20, H-13, and others. He's kept his NiColoy recipe a secret by not patenting it, he says, and is expanding its use into compression molding and other applications. Offering a final piece of advice, he urges molders and moldmakers not to throw away mismachined components rashly; rebuilding them with selective electroforming may save thousands of dollars.—*Amie Chitwood*

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