What are the changes in Electroplating?

**“NEW DEVELOPMENTS IN PLATING”** is a talk I gave April 1, 1989 to the “Golden West Regional ASEF conference.

Many of the items were known and used at the time of the writing; some were not yet started commercially. Let’s see where we stand today.

**Introduction**

New developments can be triggered by many different events. For example: Products are developed to fill a specific need such as protection of a particular metal or alloy; or to form a hard surface on a softer material; or to color a surface and many more triggers. Products and/or processes may be developed to respond to a safety or environmental consideration or a government regulation, which may cause traditional products to become obsolete, outlawed or no longer useful. Then there are the accidental discoveries made when researchers are looking for something else. This paper deals with a few new developments. (I don’t know all of them, nor do I have time or paper to discuss all that I do know. I hope the ones I have chosen will spark some interest.) I consider new developments to be a look into the future. (November 8, 2005, compared with April 1, 1989, 16 and ¾ years later)

**Chrome Replacement**

The EPA’s Final Report #PB 85—115905, “Health Assessment Document For Chromium,” documented that hexavalent chromium has been shown to cause mutations by causing problems with DNA(1): “Therefore, long known as a material that can cause or contribute or contribute to dermatitis, breathing problems and cancer, is also a possible cause of birth defects.”

It is not difficult to predict that the reduction or elimination of hexavalent chrome plating and conversion coatings is in sight.

How can chrome plating be replaced or reduced in use? Several possible substitutes are now available with no doubt more to come as the pressure mounts to remove hexavalent from plating shops.

Trivalent chrome plating is gaining popularity for decorative chrome plating, and or hard chrome applications.

Electroless nickel can offer applications in many areas where hard chrome is now used. Electroless nickel can be hardened to give a good wear surface. It can be plated Bright to produce a reflective surface.

Electroless nickel has already served to provide excellent shielding, but by its self may not be conductive enough for low contact resistance. A thin gold layer over EN-P or nickel-boron solutions is similar to hard chrome in wear, abrasion, coefficient of surface friction and abrasion resistance, and electroless nickel is superior to chromium in many corrosive environments.

Also contending as chrome replacements are plasma spray and detonation spray processes. Many materials, including hard metals, stainless steel, and even ceramics can be deposited this way. Ion implantation is another contender, along with laser surface modifications.

**Cadmium plating** is disappearing. The toxicity of cadmium and the difficulty in waste treating the effluents to meet the new standards have caused people to try to find substitute materials. MIL-Std-186D “Protective Finishes for Army Missile Systems” states, “4.16 Cadmium plating shall be restricted to essential applications only.” Use zinc plating, tin plating or aluminum coating instead. Tin plating is not likely to be satisfactory since it is not very protective. However, some tin-containing alloys may be suitable. Zinc, zinc-nickel and aluminum be ion vapor deposition have been used to replace cadmium in some applications. New, better alloys are needed to completely fill the need. Boeing has a patented zinc-nickel process for license that claims equivalent or better corrosion protection to that of cadmium. Because of the low couple to aluminum, electroless nickels are used for some cadmium replacement.

**Zine** from the newest technology: non-cyanide alkaline plating solutions is finding wide application. Its superior covering and throwing power, low cost and ease of waste treatment along with ease of control makes it a likely candidate to replace most cyanide zinc solutions. The newer acid chloride zinc processes afford good protection and bright decorative deposits.

**Pulse plating** is opening doors to better plate distribution for some metal deposits. But more importantly, pulse-plating devices can allow alloys to be plated that would not produce satisfactory deposits using D.C. plating. Examples are: Au-Fe, Cu-Fe, Ni-Fe, Co-Ni-Fe, Cr-Fe-Ni, Fe-Ni-Ti, etc.(2) Further, control of the structure of the deposits is possible. For example, “super-lattice” alloys can be produced and ductile amorphous alloys can also be produced. This is an area of the leading edge of plating technology.

Metals and alloys of these metals that have been reported using pulse plating are: germanium, Inium, Lanthanum, Lithium, Magnesium, manganese, Molybdenum, Ruthenium, Antimony, Selenium, Tellurium (3&4), Titanium, Thallium, Zinc and Zirconium.

**EMI Shielding** although not new, is becoming essential to electronic devices. Plated (electroless copper and electroless nickel) offer many advantages. All types of electronic device containers must have shielding properties. Plated ceramic micro-spheres to include in resins used to coat non-conductors, provide excellent shielding properties. Electroless nickel provides shielding, but by its self may not be conductive enough for low contact resistance. A thin gold layer over EN-P or nickel-boron offer solutions to these problems.

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**Guest Editorial - For Plateworld.com**

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Electronic connector makers are exploring and producing, on a small scale, plastic connectors plated with about 1 mil of electroless nickel. This emerging technology is expected to grow. The advantage is in its corrosion resistance.

Co-depositing solid materials with electroplating and electroless plating is moving into new territory. For example, codeposited fluorescent pigments that color-plated copper, zinc, nickel and EN have been reported. Codeposited polymers such as PTFE and others impart low surface friction properties.

Waste treatment of plating and processing solutions is of great importance now and increasingly so in the future. Process chemicals that are easier or less expensive to treat will find a place in our industry.

Toxic materials are of concern in terms of the safety and well being of plating personnel as well as concern for the high cost of the liability they represent. There is a trend toward the use of non-toxic or less toxic chemicals.

References:

1. E. C. Groshart, SurFin’88, Los Angeles L-6 June 1988