



ionEdge Corporation

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Zero-Waste Dry Plating

DESCRIPTION OF THE TECHNOLOGY

With support from the Environmental Protection Agency's (EPA) Small Business Innovation Research (SBIR) Program, ionEdge Corporation has developed and commercialized an innovative metal-plating technology that results in "zero-waste." It eliminates most of the air emissions, wastewater, and solid and hazardous wastes associated with zinc and cadmium plating. One EPA study noted that electroplating effluents are the single largest source of natural water contamination in the United States (Electroplating Wastewater Sludge Characterization, EPA-600/52-81-064). Much of the waste from conventional electroplating operations is associated with contaminated rinse waters, which require treatment and subsequent disposal of a hazardous sludge in an approved landfill.

To address environmental and occupational issues related to electroplating, ionEdge achieved zero-waste plating by using the novel concept of a vapor bath inside a vacuum in lieu of the conventional liquid bath in air. Furthermore, special technological features of the ionEdge process allow for material recycling. Only the parts exiting the chamber are plated, leaving the chamber and racks free of deposits. The sealed chamber operation also minimizes operator exposure to hazardous particle emissions. The dry-plating line consists of only four process steps as opposed to the dozen bath operations in conventional electroplating, and a waste treatment facility is unnecessary.

SIGNIFICANCE OF THE TECHNOLOGY

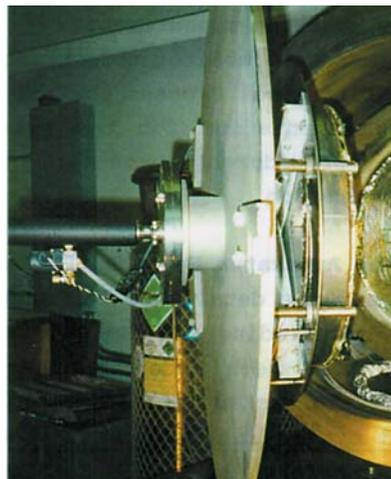
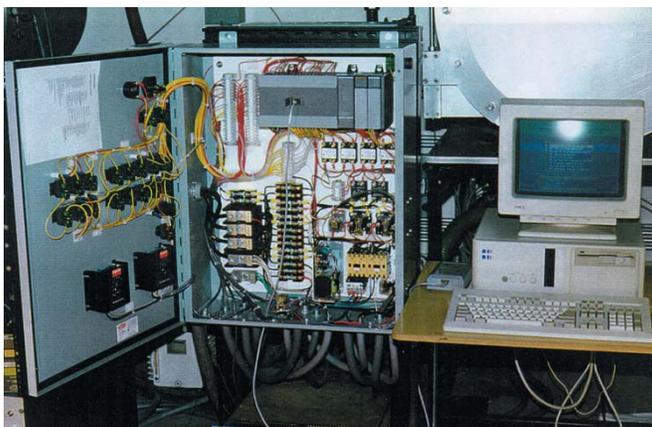
ionEdge's zero-waste dry plating process eliminates the costs and liabilities related to the transport and disposal of hazardous sludges; waste treatment savings are estimated to exceed \$1,000 per day for the average electroplater. Because ionEdge's plating process takes place in a sealed chamber, it also minimizes operator exposure to hazardous particle emissions and eliminates solid waste by facilitating *in situ* recycling of the metals used in the plating process. In addition, this dry-plating process uses less chemicals, requires 75 percent less energy, and reduces water consumption by an order of magnitude in comparison to conventional electroplating processes.

Zinc and cadmium coatings are electroplated on steel hardware components used in the defense, aerospace, automotive, and construction industries to protect them from corrosion in natural environments. The electroplating process is occupationally and environmentally hazardous because it requires the use of toxic liquids and generates large quantities of contaminated wastewater and solid and hazardous wastes.

A rack plating apparatus using ionEdge's process has been in production for more than 4 years. For a batch of parts, the start-to-finish process time for the degrease-to-chromate operation is about 30 minutes. The quality of

SBIR Impact

- ✦ ionEdge has developed a zero-waste dry plating process that eliminates most of the air emissions, wastewater, and solid and hazardous wastes associated with zinc and cadmium plating.
- ✦ ionEdge's dry plating process eliminates the need for conventional toxic plating bath liquid chemicals and minimizes the liabilities related to the transport and disposal of hazardous sludges.
- ✦ The zero-waste dry plating process is economical—it requires 75 percent less energy, reduces water usage by an order of magnitude, and results in waste treatment cost savings of approximately \$1,000 per day, for an average electroplater.
- ✦ ionEdge's in-house dry-plating line has been certified for use by an aerospace company. ionEdge is seeking strategic partnerships for implementation of a plan to expand the dry plating line to increase throughput by an order of magnitude, along with installation of a full commercial production line for high-volume processing (10,000 parts/hour).



ionEdge achieved zero-waste plating by using the novel concept of a vapor bath inside a vacuum in lieu of the conventional liquid bath in air. This technology eliminates most waste associated with plating; reduces chemical, water, and energy consumption; and significantly reduces waste treatment costs.

ionEdge's cadmium coatings has been acceptable according to standard federal and U.S. military specifications, and the coatings have performed well in more than 7,000 hours in salt-fog tests. The apparatus and process developed during the EPA SBIR project were upgraded and improved to meet customers' requirements in pilot production. In-process improvements and adjustments were made to maintain product quality and to achieve process repeatability. Test samples from three prospective customers were coated on the pilot line. The quality of these coatings was evaluated and approved by all three customers.

COMMERCIALIZATION SUCCESS

This success led to the first commercial sale of the dry-plating process to an aerospace customer who requested ionEdge to set up three additional processes to complete the customer's plating line. The expanded plating line and processes have been certified for coating aerospace parts, and ionEdge continues to provide coating services to the aerospace industry. During 1998 alone, more than 50,000 steel components were cadmium dry plated on this plating line. These components are now in service in commercial airplanes, jet fighters, helicopters, and mis-

siles. ionEdge is preparing a business plan for expanding the dry-plating line to increase the throughput by an order of magnitude (in the range of 2,000 parts of 1-inch size/hour). Simultaneously, a full commercial production plating line will be installed for high-volume parts processing (10,000 parts/hour), which will allow customers to evaluate the full economic benefits of the dry-plating process. ionEdge is seeking strategic partnerships for implementation of this expansion plan.

AWARDS AND COMPANY HISTORY



Due to its outstanding technological contributions over the years, ionEdge Corporation was awarded the prestigious 1998 Tibbetts National Award by the U.S. Small Business Administration. The company was founded in 1988, with the specific goal of developing environmentally safe coating and surface finishing methods. ionEdge's cadmium-plated parts are in service in various fighter and commercial airplanes, helicopters, and missiles. The technology has been extended to plating other metals such as aluminum, copper, chromium, and nickel on ceramics and other non-conductive materials.

What is the SBIR Program?

EPA's Small Business Innovation Research (SBIR) Program was created to assist small businesses in transforming innovative ideas into commercial products. The SBIR Program has two phases—Phase I is the feasibility study to determine the validity of the proposed concept and Phase II is the development of the technology or product proven feasible in Phase I. EPA also offers Phase II Options to accelerate the commercialization of SBIR technologies and to complete EPA's Environmental Technology Verification (ETV) Program. For more information about EPA's SBIR Program and the National Center for Environmental Research, visit <http://www.epa.gov/ncer/sbir>.