

# Chromium Plating from a Trivalent Bath using the *Faradayic* Process

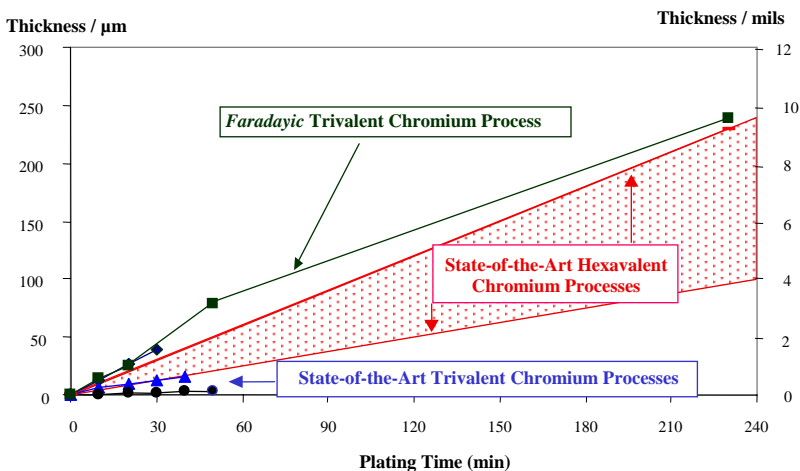
## Objective:

This project demonstrated the feasibility of depositing thick, hard, functional chromium from an environmentally benign plating bath using the *Faradayic* Process.

## Summary:

A *Faradayic* Process uses a trivalent chromium plating bath as a replacement for hexavalent chromium for functional applications. Key technical parameters for hexavalent chromium plating compared to the *Faradayic* Process are illustrated in the table. Plating thickness vs. time for 1) the *Faradayic* Process, 2) state-of-the-art hexavalent chromium plating, and 3) state-of-the-art DC trivalent chromium plating are shown. An equivalent microstructure to hexavalent chromium and good adhesion at a 10 mil thickness was obtained.

	<i>Faradayic</i> Process	Hexavalent Chrome Plating Process
Thickness Demonstrated	10 mils (250 $\mu\text{m}$ )	10 mils (250 $\mu\text{m}$ )
Plating Rate $\mu\text{m/hr}$	86 to 135	46 to 76
Hardness (Vickers)	Equivalent	Equivalent
Current Efficiency	30%	24%
Bath Cost	\$5.53/lb Chromium	\$4.81/lb Chromium
Equivalent Microstructure/Adhesion		



## Background:

The patented *Faradayic* Process is an electrochemical manufacturing technique that utilizes a controlled electric field to electrodeposit a material of interest. Since the *Faradayic* Process is electrically mediated, it does not require small amounts of proprietary chemicals to facilitate the metal deposition as needed in conventional electrochemical processes (e.g. DC). The material deposition rate is determined by the applied electric field, which is user-defined and computer controlled. This provides the means for precise control of the process length, the total material deposited and the deposit properties.

The *Faradayic* Process technology illustrated above is protected by a substantial patent portfolio including issued, allowed, and pending patent actions.

