

# CADFEM Consulting

## Electric Field of an Electroplating Cell

Analysis of the Current Density Distribution and Plating Thickness for Plated Parts using Nonlinear Potential Field Simulation

Your Contact Person:

Dr. Jürgen Wibbeler  
Phone 030-4759666-23  
E-Mail [jwibbeler@cadfem.de](mailto:jwibbeler@cadfem.de)

### Task

For an electroplating process the local thickness and quality of the plated layer depends on the local electric current density on the surface of the parts. Typically the current density is highest on edges and lowest for sunken regions of the surface.

The current density distribution across the parts is investigated using an electric field analysis and the resulting layer thickness is then calculated.

### Solution

For calculating the current conduction field an ANSYS® FEM model is created from the electroplating cell's electrolyte volume. The electrolyte conductivity is assigned to this FEM mesh as a material property.

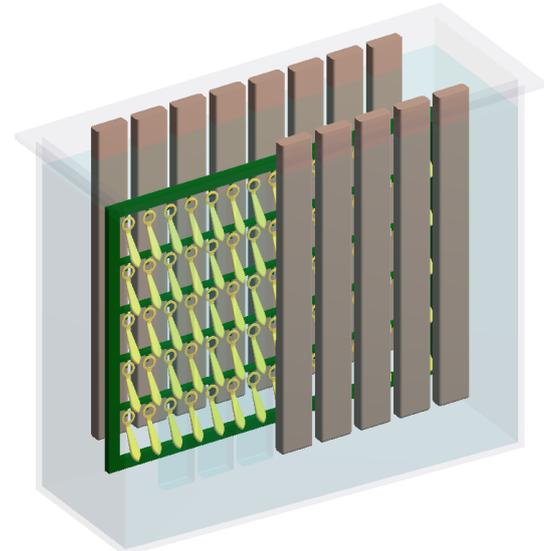
A local potential drop develops at the boundary between metallic parts and an electrolyte and this has a nonlinear relationship to the local current density. This boundary potential is called "overpotential". It affects the current density distribution across the parts and has to be determined in a laboratory for each specific combination of metal surface and electrolyte. Once known this function can be implemented into the simulation as a nonlinear surface boundary condition.

After applying the given cell voltage or current the FEM analysis returns the current density distribution on the parts. The resulting local layer thickness is finally calculated from the local current density, given plating time and various coefficients.

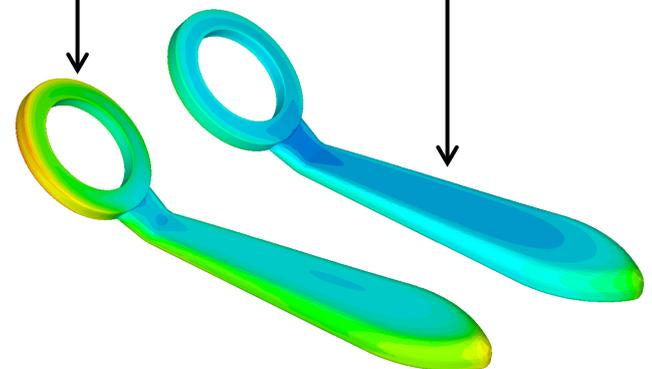
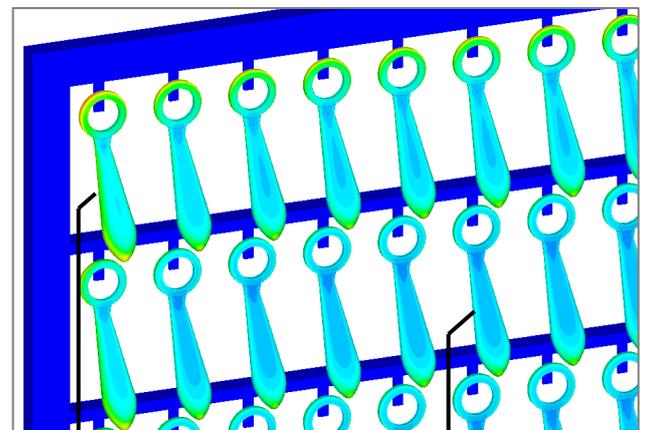
### Customer Benefit

The simulation allows for optimization of the electroplating cell and parts:

- Predicting fluctuations of layer thickness and quality across the parts as well as across rack positions
- Investigating the interaction between multiple parts in an electroplating cell
- Designing anode shapes, non-conducting shields or modifying parts for optimum plating conditions
- Reducing plating material consumption by homogenization of layers



Electroplating cell with parts on a rack



Final layer thickness in microns