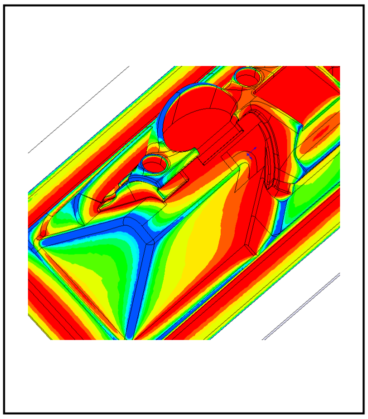
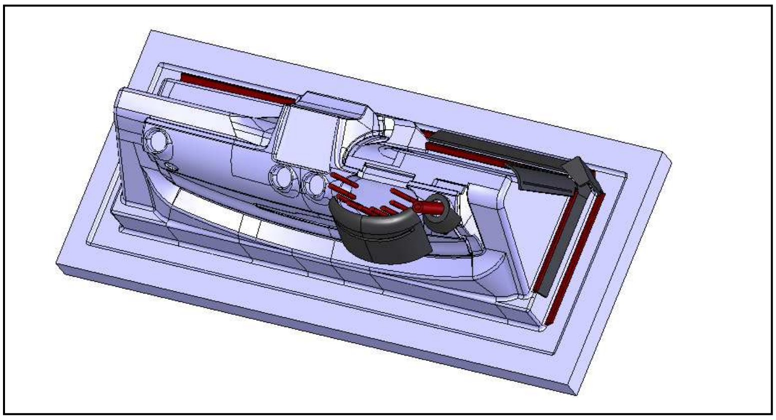
electrochemical intelligence

APPLICATION CASE

Simulation of the nickel electroforming process for plastic fabrication moulds

Automotive Solutions applied with Electrochemical Intelligence





The Need

Electroforming is a common process technique for making moulds and dies used for manufacturing plastic composite automotive components like dashboards and decorative trims. While the process of forming one mould at a time limits production, the process is also technically laborious and slow. Each component requires labour intensive anode and shield designs, different incremental plating steps with expensive corrective grinding and anode design modification just to achieve an acceptable result. Since time-to-market and labour costs are 2 critical components of this manufacturing step it is desirable to speed-up production and optimize the process. Ultimately this reduces material and labour costs.

The Design Challenge

It is well known that the step-by-step, layer and grind, electroforming process can take weeks to obtain a required uniform layer thickness of just a few centimetres. Arriving at an optimised anode and screen configuration from the beginning results in a more uniform deposit thickness and little or no corrective grinding is needed.

However, due to the massive number of anodes and screens needed per mould, especially for the more complicated ones, their design requires huge experience and effort. It is acknowledged that a first time "hit" on the exact configuration is highly unlikely without using computer modelling to get it right the first time. Time-consuming, labour intensive "trial and error" is accepted as an inherent step in the electroforming process. With each process requiring several corrective cycles of design and preparation of anode and shield configurations, forming, measuring, and grinding, the costs in terms of time, labour, materials and energy are the only things that build up quickly.

The Solution

In extreme contrast to the many hundreds of hours that calculation and preparation normally take to manufacture a mould, defining the optimal anode and shield configuration using Elsyca's Advanced Engineering services takes a very short time.

Elsyca's Advanced Engineering team uses Elsyca's PlatingMaster software for the "virtual" definition and manipulation of anode and screen configurations and the computation of resulting layer thickness distribution. Visualisation of the end results includes a probe able to determine deposit thickness at specific points of the mould.

Full visualisation and computation of several alternative configurations allow Elsyca Advanced Engineering Services team to pick the best and go to actual production with a 'right the first time' option. With the right start the electroforming process at each level achieves accurate specified layer thickness, greatly reducing the need for grinding as well as the number of process cycles needed.

Correlation between the simulated and actual thickness values is excellent.

The Benefits

A systematic and structured approach delivers immediate and measurable results for your business. Fast and accurate design configurations mean production runs start sooner with a 'right first time' optimal set-up and achieve better results. Besides increasing production potential, huge cost savings are obtained with preparation and process time significantly reduced. The "virtual" elimination of grinding steps, reduced material costs and energy consumption can be easily calculated. With faster time to market achieved and dramatically reduced labour and material costs, the mission is accomplished.

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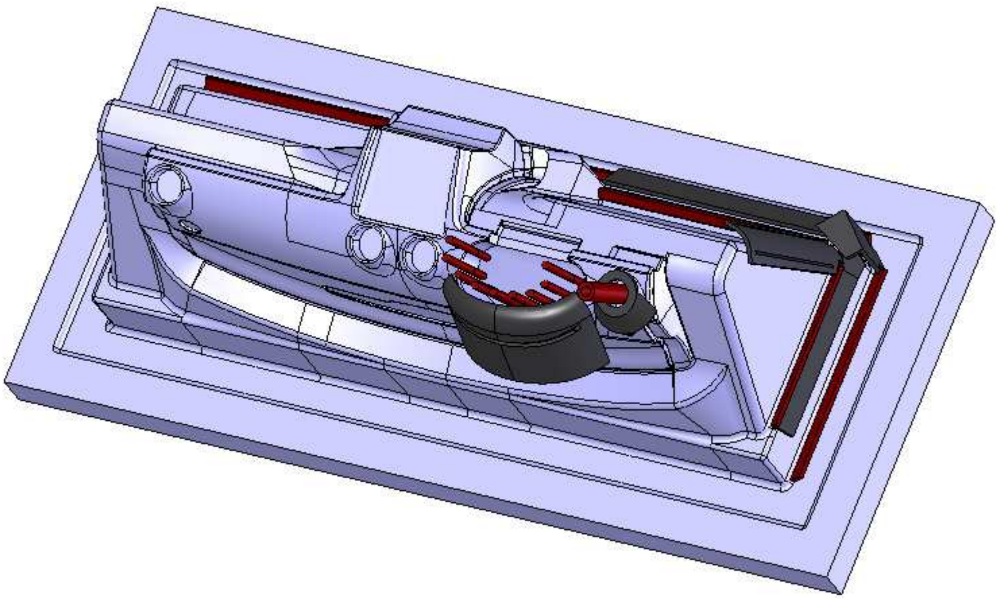
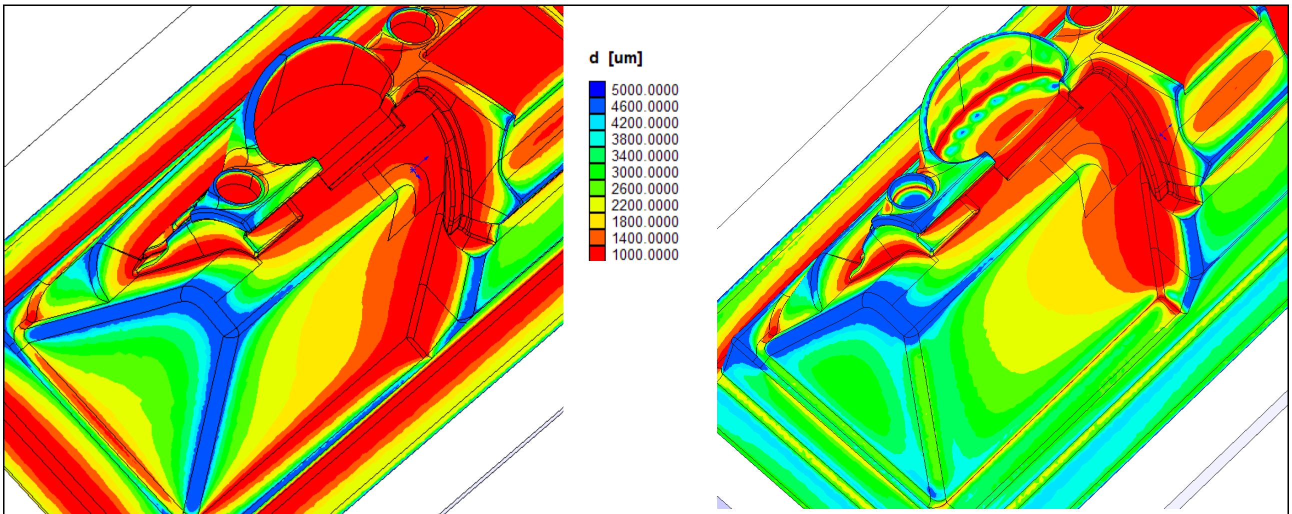


CAD configuration of a dashboard mould with auxiliary screen (grey) and anode (red) structure



Deposit thickness distribution over the mould for a situation
without auxiliary screen and anode structure (left) and with this structure (right)

The top figure shows a dashboard mould with a small part of the plastic screen and auxiliary anode structure. The plastic screens counteract the excess of metal deposit near the corners, while the auxiliary anodes (any possible shape) reinforce the deposit in recessed areas. The computed layer thickness distributions are plotted in the next figure, both for a mould with and without auxiliary structure. An intelligent design of the auxiliary structure can bring deposit thickness values at nearly any spot on the mould directly within specifications.

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