

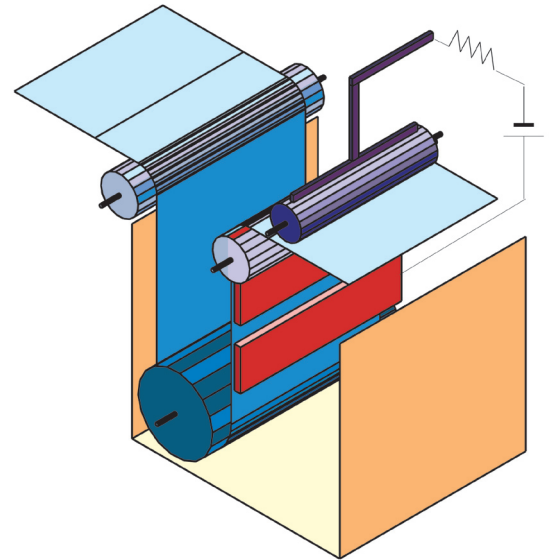
Elsyca Elsy2D

Expert software for electrochemical modelling

Elsy2D, an Elsyca product with proven track record, is a unique and user-friendly 2D software program providing a platform for the simulation and optimisation of the complete range of electrochemical processes:

- Electroplating
- Anodising
- Reel-to-Reel Plating
- Electroforming & Electrowinning
- Electrochemical Machining
- Cathodic Protection

Based upon your specific requirements, Elsy2D's modular approach provides a customised solution with significant added value at a competitive price.



Elsy2D benefits your electrochemical process business by providing:

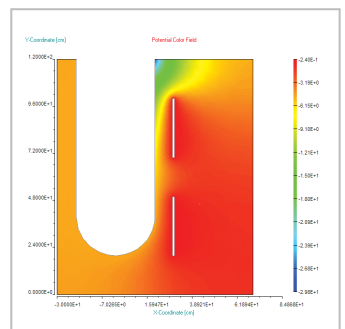
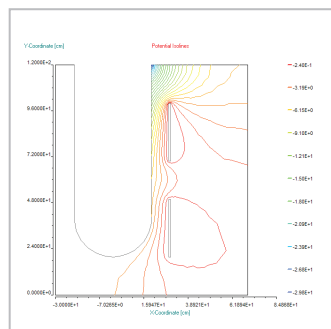
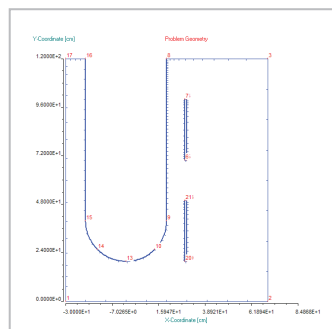
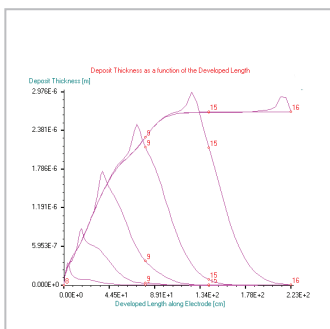
- an in-depth insight and understanding of your electrochemical processes,
- enormous time and cost savings from the design to manufacturing phase,
- optimisation towards process yield, product quality (e.g. uniform electroplating thickness) and through-put.

When using the Elsy2D software, you can count on:

- detailed documentation,
- customised on-site training by the expert team of Elsyca,
- responsive technical support.

Elsy2D has already proven its benefits several times:

- "Elsy2D's architecture is a well-considered concept with a logical structure, as a consequence, it is very user-friendly" (Dr. Jacques Wijenberg, Corus Group - The Netherlands)
- "The Elsy2D software has proven to be a valuable modelling tool to obtain better quality electrodeposits on our existing wire products. Moreover, it has facilitated an accelerated development of new electrolytic coating techniques for Bekaert such as the Cu-plating for flexible circuits. We clearly intend to continue using Elsyca's software tools within Bekaert. (Dr. Wim Vanvooren, Bekaert N.V. - Belgium)
- "Elsy2D is a very powerful tool for our research work and we use it successfully for various applications in electrochemical plating processes." (Dr. rer. nat. Manfred Rössler and Dr. techn. Maximilian Staudacher, Robert Bosch GmbH - Germany)



Elsy2D Basic Program Key Features:

- Two-dimensional and axi-symmetrical electrochemical cell configurations
- Easy data input: the cell configuration can be defined based on geometrical parameters, enabling easy modification
- Definition of electrode types, mass transfer limitations, imposed current or potential values are straightforward using the Elsy2D Input Wizard
- Automated meshing
- Fast solver: most configurations can be computed within a few minutes on a standard PC
- Visualisation options: current density and layer thickness distributions along the electrodes; potential isolines and current density vectors over the electrolyte domain(s); electrode shape evolution over time for electroforming and ECM applications

Elsy2D Basic Program Solver Features:

- Electrode polarisation & efficiency defined by linear or Butler-Volmer type relations, or through direct import from experimental data
- Electrodes with high internal resistivity
- Time dependent decrease of the internal electrode resistance
- Imposed potential on different electrodes
- Imposed current through one or a collection of electrodes (includes floating and bipolar electrode modelling)

The possibilities of Elsy2D can be expanded with the following dedicated add-on modules for modelling specific phenomena and processes:

- Mass transfer limitations: enables modelling of the effect of inadequate electrolyte agitation or replenishment on metal ion transport to the cathode for simple hydrodynamic cases (e.g. flat plate or parallel plates with parallel flow).
- Multiple regions with different electrical conductivities: for cells with an anolyte and catholyte region, and for cathodic protection applications.
- Reel-to-reel plating cells: dedicated software for very thin or resistive moving sheets and wires.
- Electrochemical machining shape change: enables computation of the anode shape change based on Faraday's law for ECM applications and other processes where electrochemical dissolution occurs over a number of user-defined time steps.
- External electrical networks: required if either the electrical wiring or the external current (or potential) sources to multiple electrodes becomes rather complex. The add-on module takes into account the resistance of contacts, wires etc.
- Electrode growth shape change: allows computation of the cathode shape change based on Faraday's law for electroforming applications over a number of user-defined time steps.
- Moving electrodes: for defining moving cathode tools that are either subject to a fixed speed or maintain a minimum distance to the product.
- Automated geometrical parameter optimisation: a powerful tool for optimisation, e.g. screens, current thieves, cathode and anode dimensions and positions, and product masking. The target can be a user-defined layer thickness distribution or a specific product shape (ECM and electroforming). The algorithm will determine the optimal set of geometrical dimensions within user-defined upper and lower bounds .

Hardware and Software Requirements for Elsy2D:

- Operating system: Windows operating system (2000/NT/XP)
- Internal memory: minimum 512 MB RAM or more recommended
- Processor: minimum 1GHz or more recommended