



CHAM

**Product Update:
ESTER – Electrolytic Smelter**

WHAT IS ESTER?

ESTER (Electrolytic SmELTER) is a special-purpose adaptation of the general-purpose fluid flow and heat transfer code PHOENICS, developed specifically for the simulation of multi-anode electrolytic smelters of the Hall-cell type. It uses a variant of the standard PHOENICS pre- and post-processors for data input and graphical display.

ESTER enables the user fully to represent the smelter in 3-D taking into account all major features of its design:

- any number of anodes in any arrangement;
- the frozen electrolyte around the edge of the cell;
- distortion of the metal-electrolyte interface due to pressure differences and due to vertical Lorentz forces;
- erosion of the anode undersides to follow the shape of the metal-electrolyte interface; and
- current generation due to the motion of the metal - the induced current;

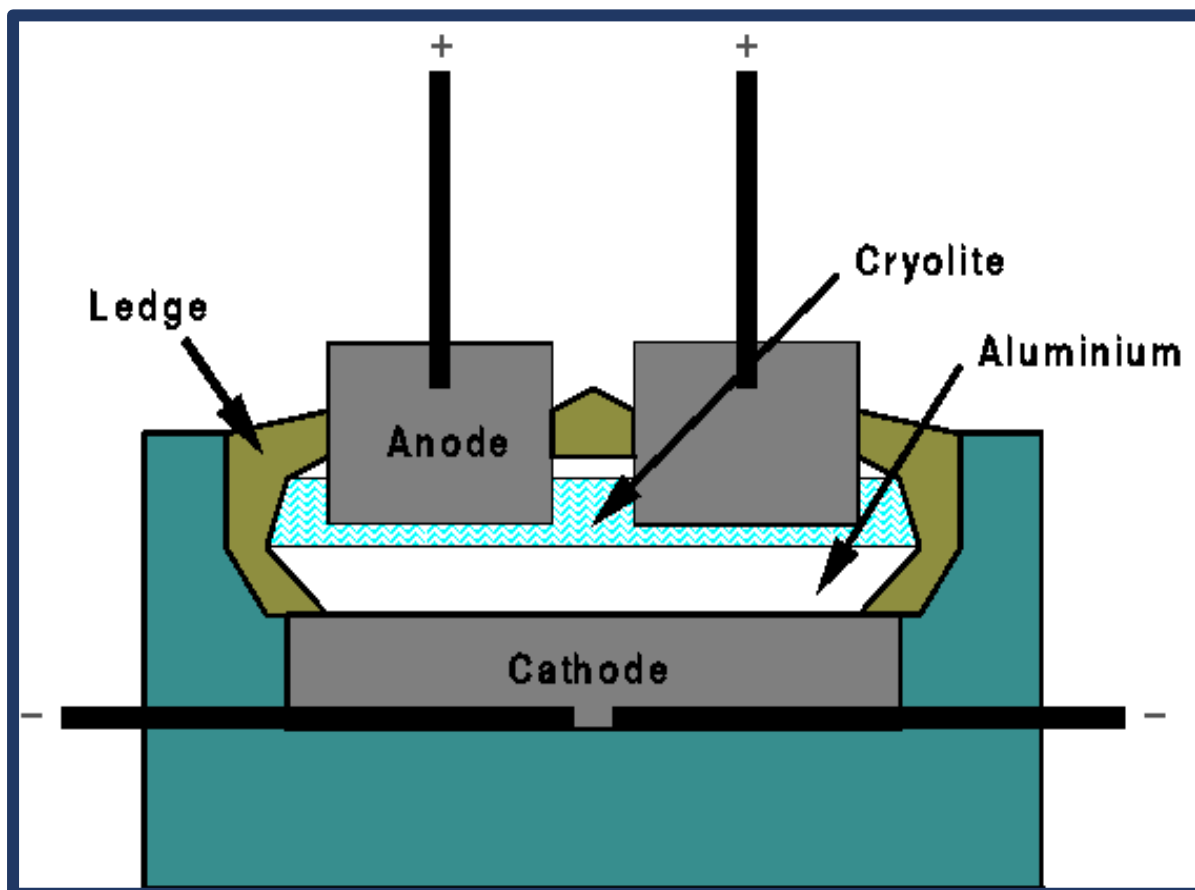


Figure 1: Cross-section of an alumina reduction cell – schematic drawing

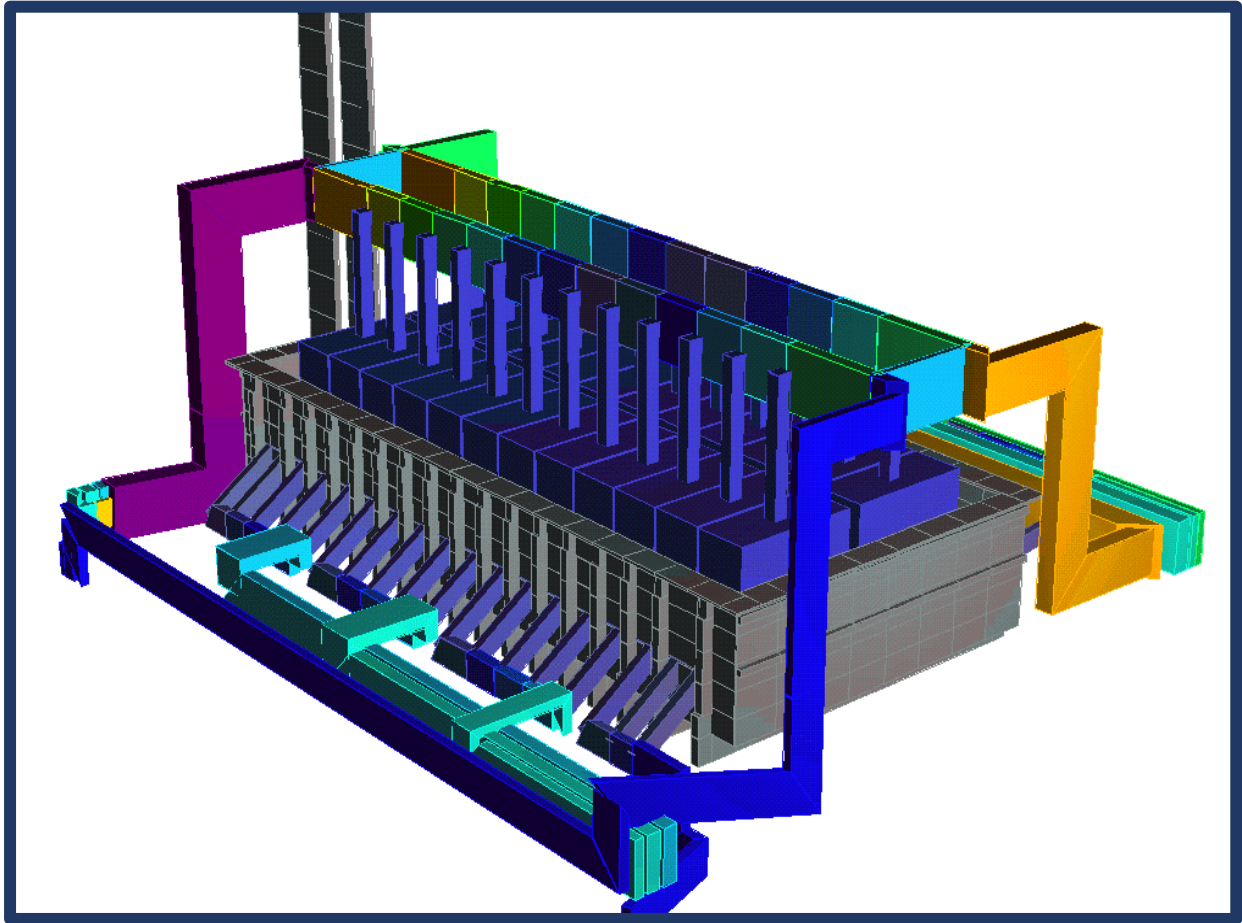


Figure 2: Simulation model of a reduction cell

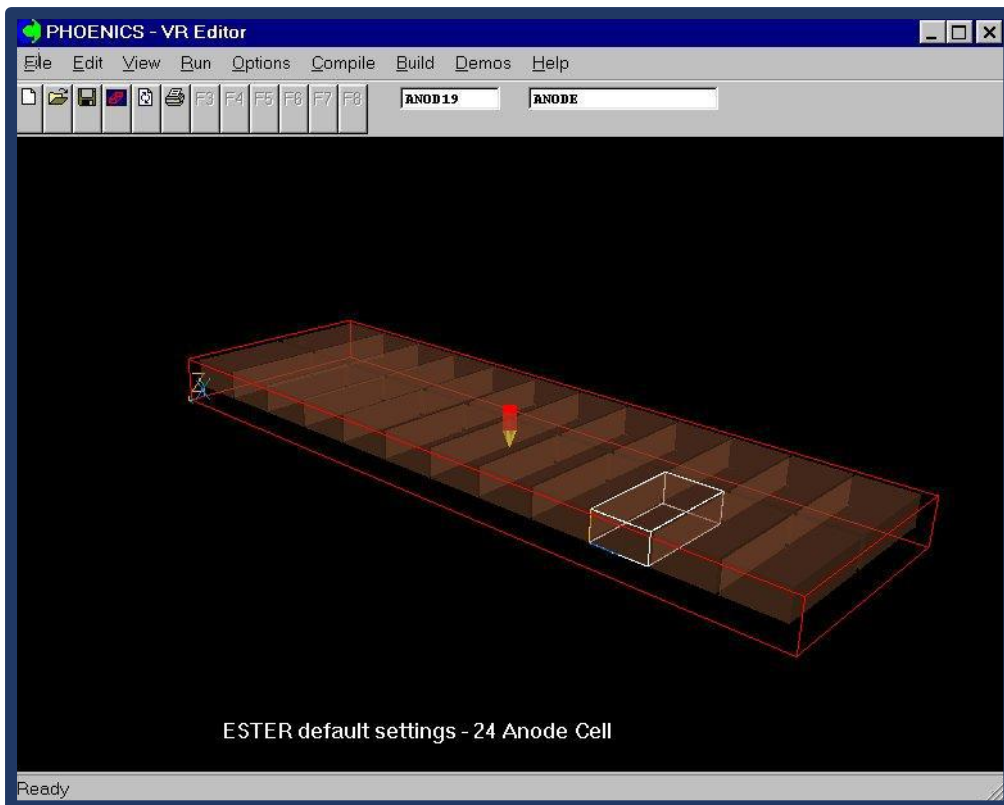
- three components of metal velocity;
- three components of electrolyte velocity;
- pressure;
- the gas fraction under the anodes, and the inter-anode gaps; and
- electric potential distribution.

Based on these, it deduces:

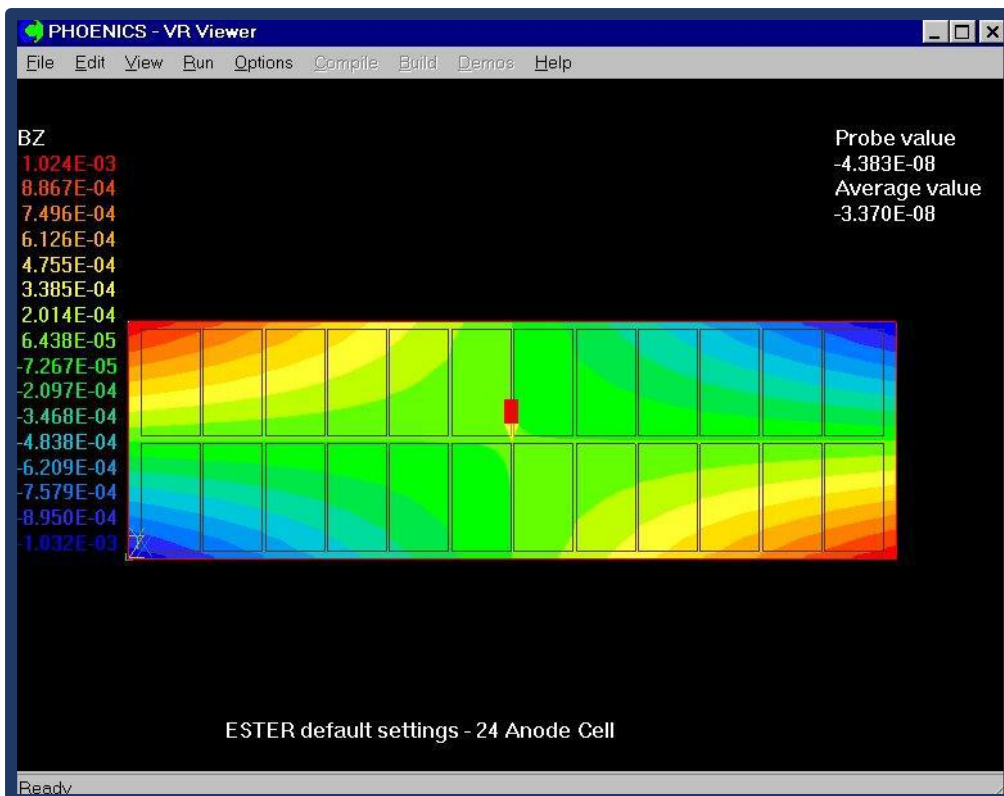
- height of the metal-electrolyte interface, height of the electrolyte free surface; and
- electric current distribution, and induced currents. These, together with given magnetic fields, are used to compute the Lorentz forces which drive the flow.

ESTER has further extensions, which include:

- thermal calculations, including the formation of freeze;
- calculation of aluminium oxide concentration in the electrolyte;
- interface to magnetic field calculation programs;
- interface to programs which can update the anode potentials and the cathode currents.



Anode 19 in raised position



ESTER Default settings – 24-anode cell

For further details, click on http://www.cham.co.uk/phoenics/d_polis/d_info/ester.htm
 Or contact Sales@cham.co.uk

Pictures courtesy of VAW Aluminium-Technologie GmbH