



CHAM Product Update

Pioneering CFD Software for Education & Industry

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.

Features of ESTER

ESTER enables the user fully to represent the smelter in 3-D taking into account all the 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;

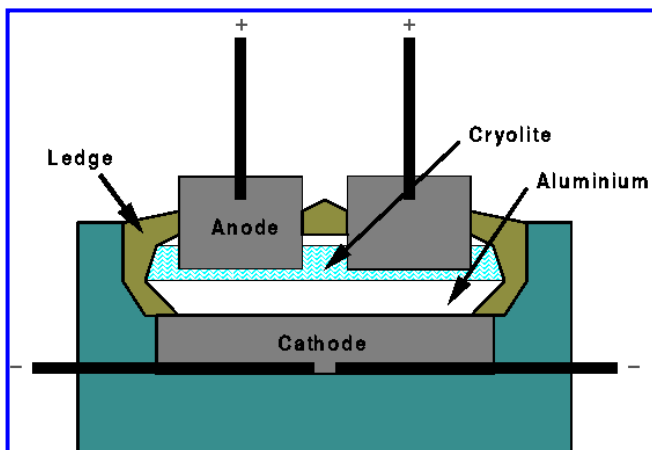
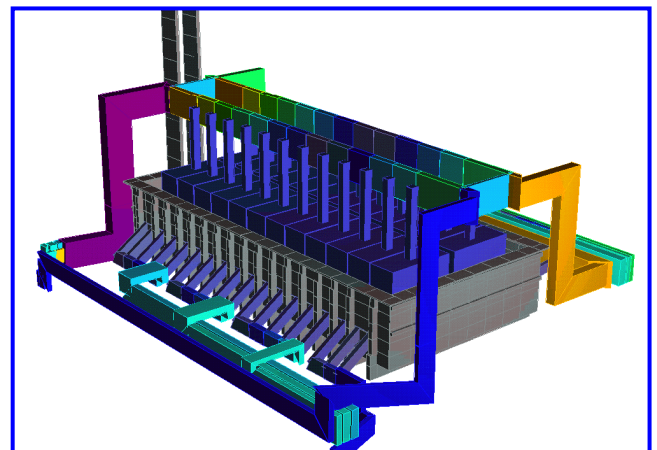


Figure 1: Cross-section of an alumina reduction cell – schematic drawing



The program solves the fundamental
Figure 2: Simulation model of a reduction cell



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

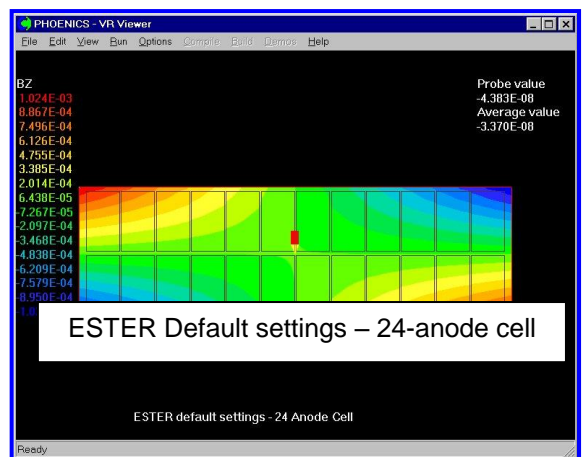
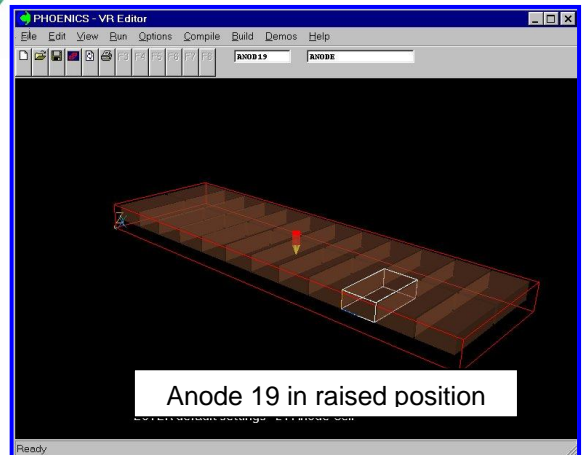
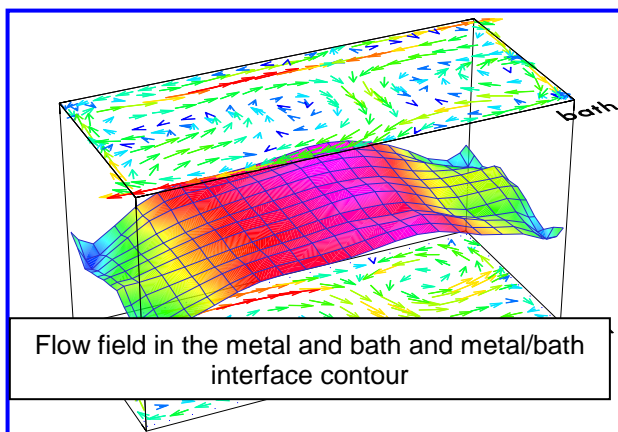
Based on these, it deduces:

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

ESTER Extensions

ESTER has further extensions, to 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.

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