





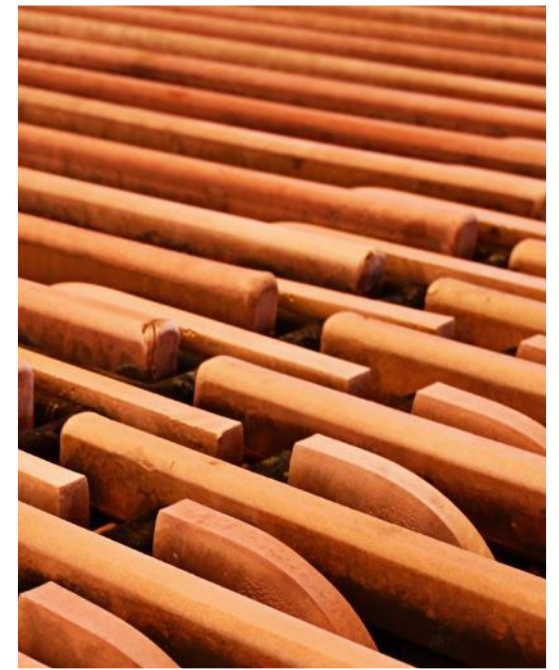
Introduction

# ABOUT US

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Pultrusion Mining is a division of **Pultrusion Technique inc.**, It distinguishes itself with copper and zinc refineries by developing and manufacturing the most durable, resistant and unique hydro-metallurgical insulators, also known as capping boards, that reduce costs and improve productivity of refiners.

**We have** an unwavering commitment to staying true to our entrepreneurial culture and our values.



# EQUIPOTENTIAL INSULATORS

*Unmatched protection  
with our insulators for  
hydrometallurgy*

*Incredible **lifespan**, without any maintenance and  
repair, up to **22 years** for copper and **19 years** for zinc.*

# Pultrusion technique Single-piece Insulator

Designed to fit at the length of your cells

The very high level of precision of our insulators, from the first to the last electrode, ensures their permanent alignment; resulting in an increase in the quantity and purity of refined metals and substantial reduction in short circuits

High level of precision throughout operational lifespan



All thermomechanical properties increased



Superior mechanical and dielectric values



*Their design allows to merge up to 4 different models and alignment*



Their designs are protected by numerous patents



They enjoy a reputation for excellence on five continents. Their reputation is still unmatched to this day.



# Main concerns

## Causes for cell failure

Cells are exposed to unfavorable internal and external factors that have a direct impact on their lifespan. Their deterioration can be caused by their construction, tensile stresses, compression, thermal shock, thermal fatigue, mechanical subduction stress zone, corrosion, suction by capillary action of acids, hygrometry, hydrophilicity and thermochemical destruction.

Their maintenance and replacement can be time-consuming, costly, difficult and environmentally unsafe.

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### Thermal shock

**Sudden changes** in temperature cause deformation of the polymer concrete cell. This thermal phenomenon leads to cracks

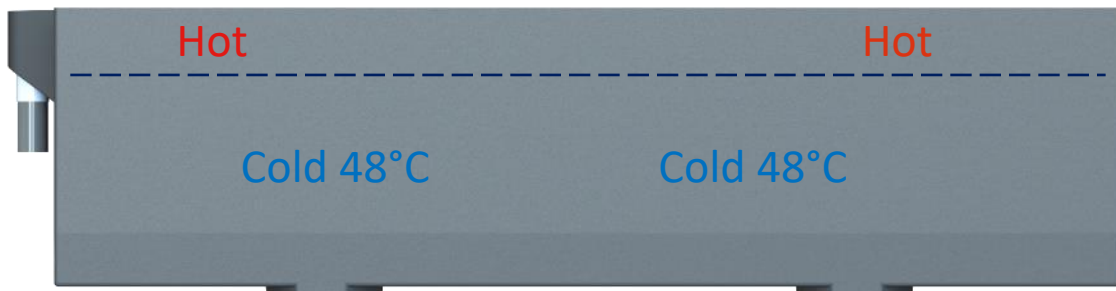


### Chemical attack

**Excessive acid concentration** leads to cracks and then to rupture of cells. Standard concrete or polymer concrete have the same behavior when facing this stress; the chemical reaction will inevitably crack the concrete.

# Thermal shock

Quick and abrupt temperature changes



## Filling



During the winter, cells get filled with acid at a temperature ranging from 34° to 68 ° C, while the bodies of the cells are initially at ambient temperature, and the cell is subjected to outside winter temperature at night



A simple difference of 14 ° C is enough to create a thermal shock. The higher the temperature or the difference between the two, the more intense the thermal shock will be.

## Short-circuits



During a short circuit, the temperature of the cell increases and the cell itself extends, creating cracks in the electrolyte level.



Thermal shock of a major short circuit will generate temperatures above 200 °C

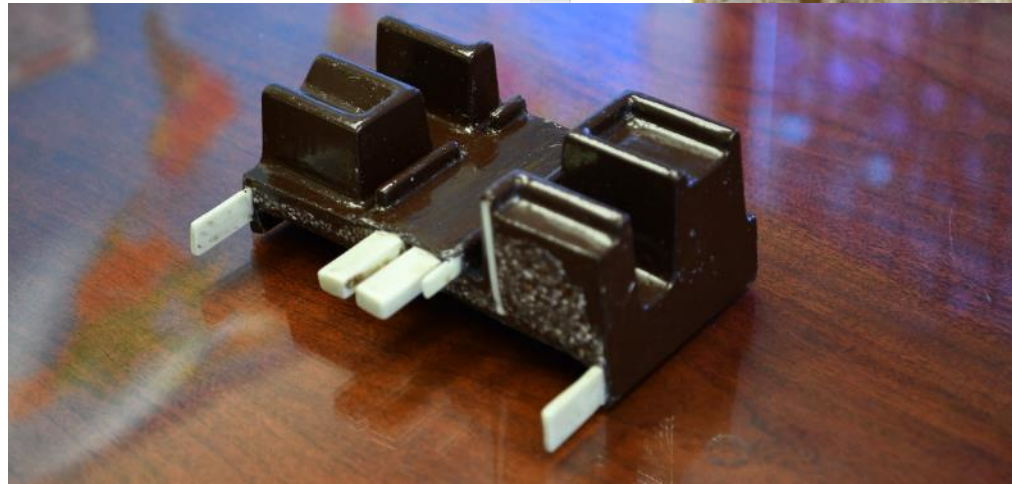
# Thermal Shock vs Pultrusion bars

If a short circuit occurs in the copper refining process, the current efficiency will decrease rapidly reducing the yield, and affecting the quality of the copper, in addition to the other stresses mentioned previously.

The pultrusion bars, embedded in our regular and coronary isolators, dissipate concentration of heat. Speed of heat transfer is 2,4 times faster into the length than into the thickness.



Theses images clearly demonstrate the embedded pultrusion bars, acting as a thermal transfer differential, which **helps dissipate heat**.



*Thermal shock have no effects on composites.*

# Corrosive

## Environment

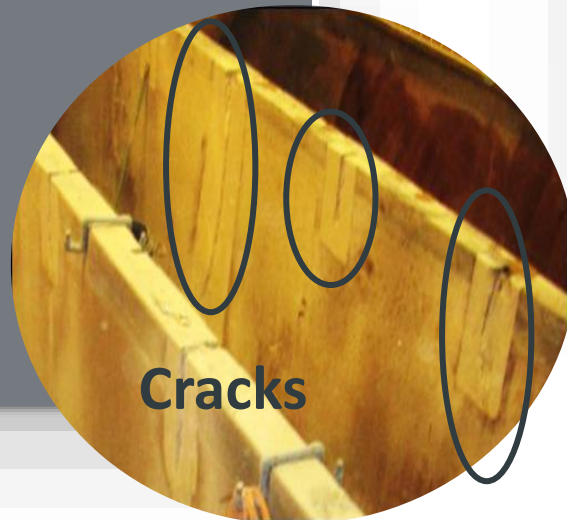
When harvesting the refined metal, acid drops fall on the top of the cell. Chemical attacks on concrete cause deterioration and affect the durability of the cell, which can lead to structural failure.

### Acid

With the heat generated by the refining process, water evaporates and causes higher concentrations of sulphuric acid.

Before evaporation: 20%  
After evaporation: 70% - 100%

▼  
Formation of cracks  
Propagation of cracks  
Disintegration of concrete



**Cracks**

## Our insulator protection

The fact that our insulators are monoblocks (without joint) with a 90 ° rim, allow them to act as an umbrella over the entire length of the cell. Acid does not accumulate under the insulator hence the integrity of the cell is not weakened.



Example of an umbrella insulator



# FORMULA

## Chemical resistance

No plastic can withstand when the sulfuric acid level reaches 70%. However, not only our chemical formulation can withstand this level of corrosion, it can do it for over 20 years without any maintenance nor repair.

The synthetic resins used in our Insulators are created using **our own chemical formulation**. They are manufactured following our own specifications; these do not exist on the market.



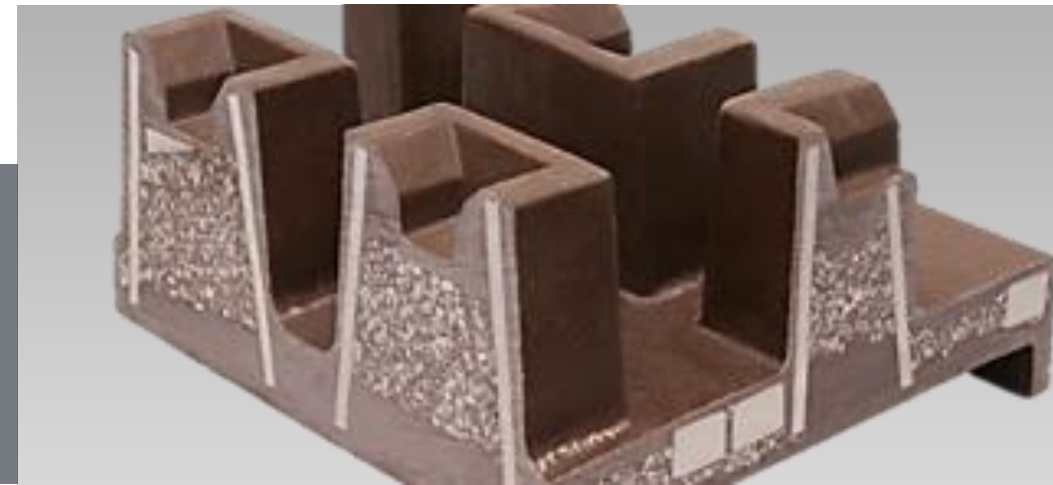
Resin matrix resisting 80% - 100% of sulfuric acid for 20 years



The chemical formulation of the rock contains less than 0.05% calcium oxide in weight, hence counter-acting corrosion by sulphuric acid.



Resin can support up to 600°C, and resists up to 200,000 Amps & 780 Volts



# Designed like an Electric insulator

To be efficient in our hydrometallurgical environment (metal salts, acid mist and very high humidity) a high-wattage electric insulator also requires two distances:

- 1) The direct distance or the shortest distance between the negative and positive poles or the ground.
- 2) The by-pass or the skirted round distance



## We can help you

Composite insulators often have weaknesses created by osmosis. This osmosis causes an electrical leak which creates anodic corrosion on the cathodes and creates cathodic corrosion on the anodes.

- ✓ In copper, cathodes last up to 20 years with the protection of our insulators.

- 1 Our insulators protect against all types of corrosion.
- 2 Our contactor insulators protect your cathodes against internal corrosion due to Van Waals forces



# High separating Walls



## High separating walls

Eliminate short circuits and electrical leakage between adjacent electrodes, and cell to cell. Electrode lifetime is 2 to 4 times over standard product.

## A design which protects electrodes

When refining by electrolytic processes, refineries regularly encounter the problem of uneven copper growth causing short circuits between the electrodes. This negatively impacts the efficiency of the hydrometallurgy purification process, consuming both energy and time for limited product yield. The efficiency of the operation is greatly reduced at a significant cost.

Not only the life of our insulators is considerable due to our chemical formulation, but our design, including high separating walls, protects the electrodes from short circuits by minimizing the possibility of lateral movement.



## Custom made

More than 85 different models of cathode and anode insulator contact system.



## Vertical pultrusion bars and rebar

Increase the mechanical strength of insulating seats up to 20 times. Insulating seat much less likely to dislocate from base

Our coronary insulator  
drastically increase the useful life of cells



HYDROMETALLURGY



# Coronary Insulator

**Acts as an insulator between the contact bar and the cell**

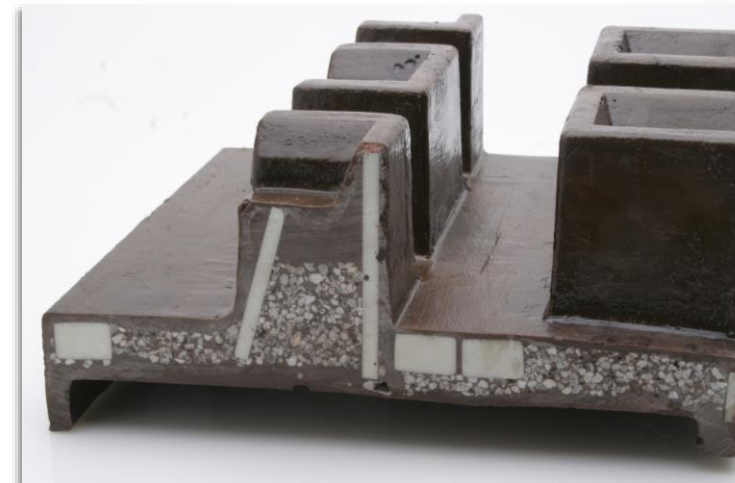
When major short circuits occur, the underneath insulator, called coronary, is designed with different layers of textiles to prevent heat from passing through our insulator, hence there is no heat transfer to the cell. With their 90 ° edges, it acts like an umbrella preventing acid drops from reaching the cell structure.

It also allows the regular insulator to remain in position and again, by acting as an umbrella, also redirects the electrolyte to the cell.

Cells that already have cracks will be protected by the coronary insulator and will **significantly extend its remaining lifespan.**



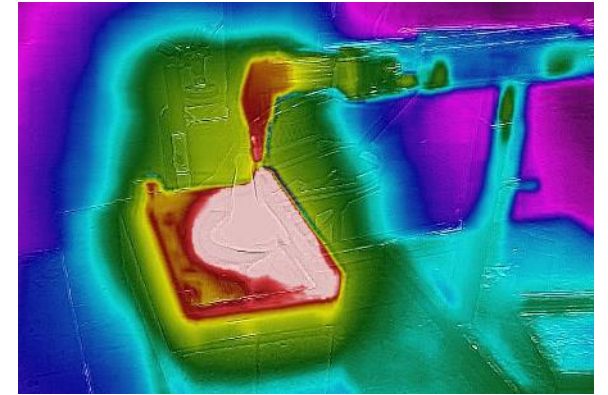
Thanks to our production process, our insulators will fit to any model of contact system.



Coronary insulator can be merged with our equipotential model, resulting in a one-piece insulator system.

# Thermal performance Test

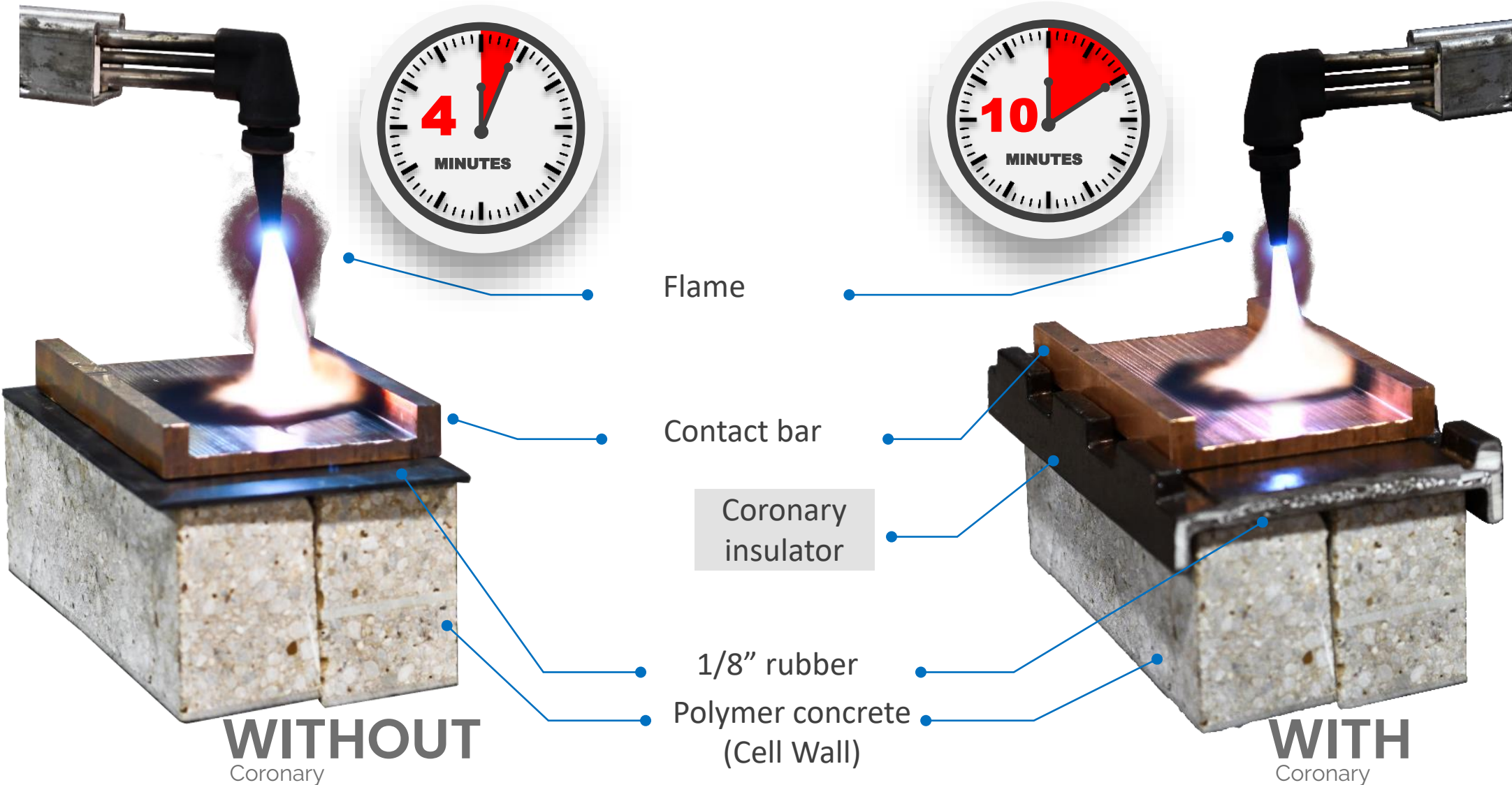
Tests carried out with, and without coronary insulator, in order to demonstrate their cell protection.



- 01 Concentrated temperature of the heating element on the contact bar up to 600 °C
- 02 Average temperature of the contact bar is  $\approx$  150 °C



# Test sample configurations

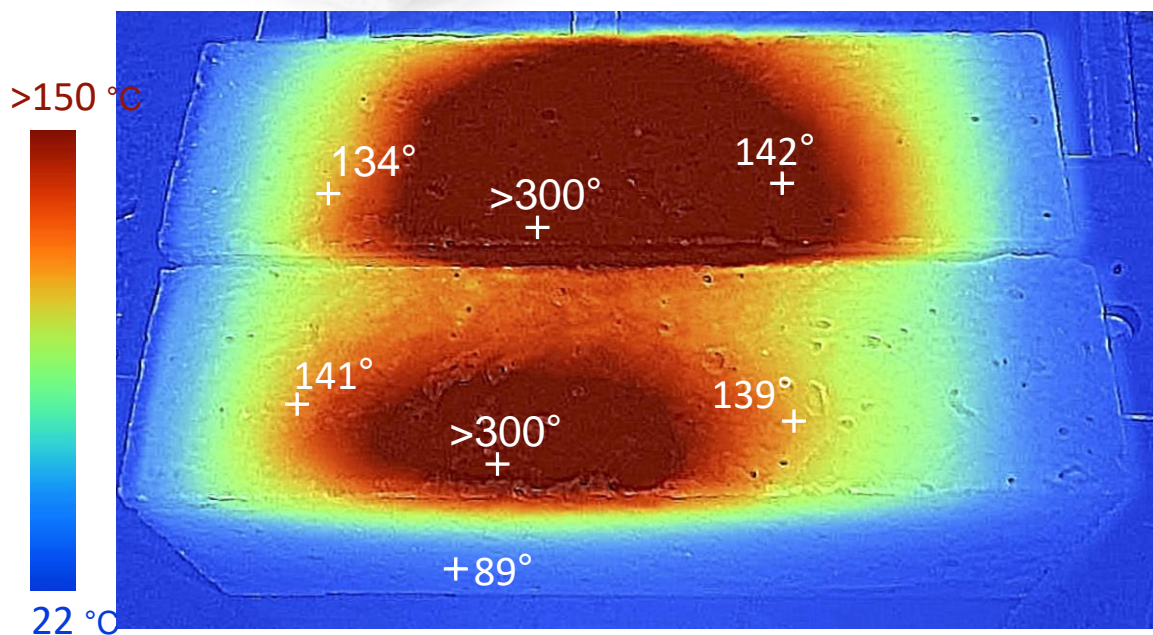
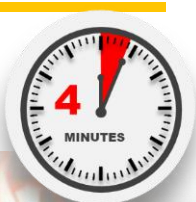




# ✓ A proven efficiency

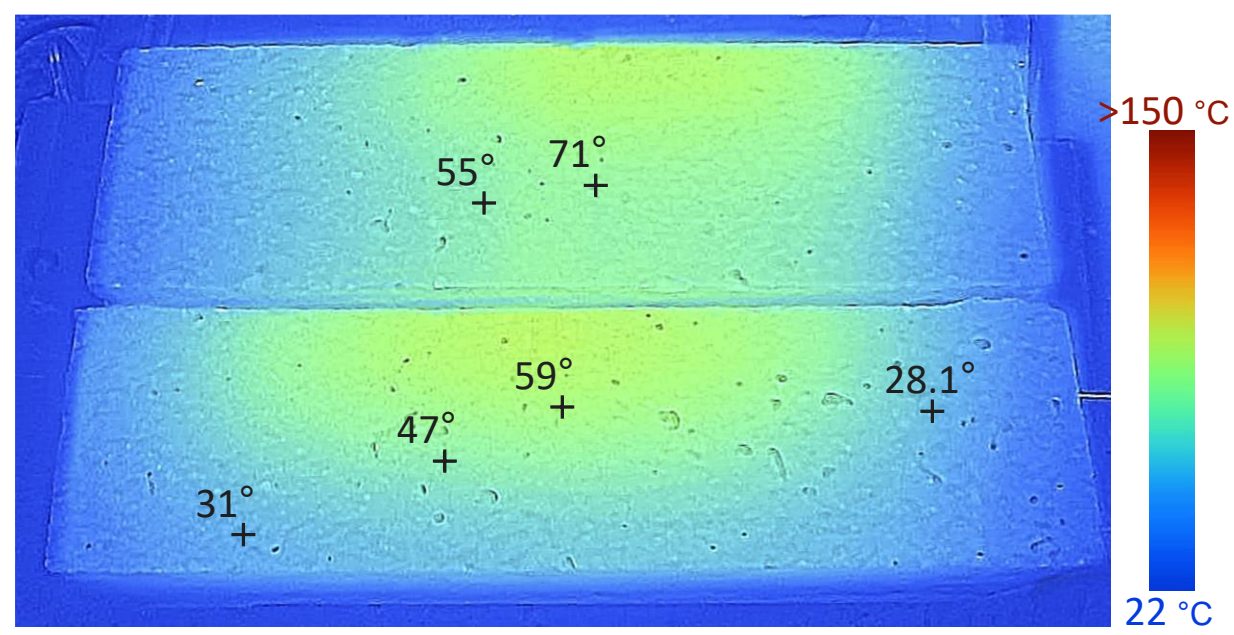
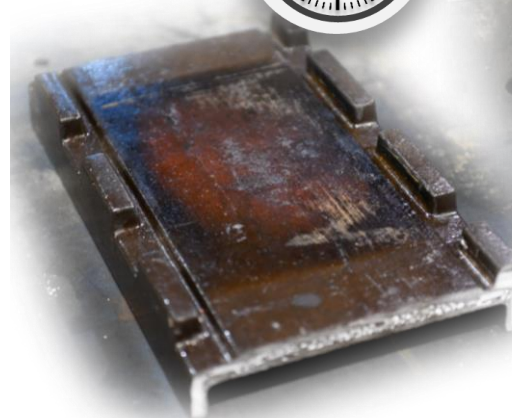
## WITHOUT

Coronary



## WITH

Our Coronary





# PROPERTIES UPHELD THROUGHOUT LIFETIME OF OPERATION

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## ■ **Dimensional consistency**

No shrinkage and permanent electrode alignment following the 3 axes. This level of precision remains constant throughout the lifetime of operation and stands at  $\pm 1,8\text{mm}$  on 6-meter length, and  $\pm 0.20\text{mm}$  side-by-side.

## ■ **High separating walls**

Eliminate short circuits and electrical leakage between adjacent electrodes, and cell to cell. Electrode lifetime is 2 to 4 times over standard product.


## ■ **Superior mechanical stiffness**

Insulating seat will not dislocate from base, no maintenance or repairs on total lifespan



## **Formula**

High resistance against acid corrosion. Lifetime of operation can exceed 20 years.



**More than 50  
years of research  
and development**



CAD 3D



FEA



Chemistry

# Innovation and Design

Innovation and Design with rigorous and comprehensive scientific processes.

Contribution of highly qualified specialists for total quality control and products with remarkable precision.

- **16 patented designs**
- **Partnerships with universities, government and private Sector**



# Case history

**During a business trip to Chile, in May 1996**, a customer informed us that three years prior, a crane operator deposited an entire cell load (cathodes) erroneously and only one cathode was in contact. This mishap was not discovered until later.

They set the current on load and the triangular contact bar went liquid as well as the cathode hanger bar, which is 1083° C (1981° F). This represents extreme stress on a VLLO insulator. Our VLLO insulator caught fire and the power was turned off. The fire, although minor, was extinguished. The electrodes were replaced in the correct position and started up again. This accident happened in April 1993, i.e. after 43 months uninterrupted service.

Dimensions and precision were not altered in any way. The insulator did not melt and resumed operation as if nothing had ever happened. It did not affect the lifetime of operation.

A similar same accident occurred in a copper refinery in Sudbury, Ontario, Canada, in 1996.

A similar accident happened in the autumn of 1995 at a copper refinery in Montreal, Quebec, Canada.

Other accidents of this type occurred in many copper refineries here and abroad.

Our VLLO insulators self-extinguish almost as soon as the liquid copper solidifies and cools down to an

acceptable temperature, or as soon as the burning flame or the source of fire is eliminated.

The time required for our VLLO insulators to self-extinguish is proportional to the size, the duration of the fire or the plasma applied onto the VLLO insulator.

We have claimed for the longest time that our VLLO bus bar insulators do not shrink after a major short-circuit, that dimensions are not altered after repeated electrical short-circuits in the same location, or spread throughout, and that they self-extinguish. The above gives evidence to these claims.

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***Our VLLO insulators self-extinguish as soon as the liquid copper solidifies and cools down to an acceptable temperature, or as soon as the burning flame or the source of fire is eliminated.***





Testimony

# ONLY SATISFIED CUSTOMERS



**We strive for excellence  
in everything we do.**

Our positive and constructive relationships with all our employees and partners are based on mutual trust and respect. Our innovative formulation, process and technology allows us to propose any size and structure of contact insulators that suit the best for you.

“

*These insulators have been in operation in our tank house for many years and we visited Technical Pultrusion on occasion. We consider Technical Pultrusion as a reliable company and we are most satisfied with the quality of their insulator, hence we have no hesitation in recommending this product.*

*Yvon Fiset  
Glencore CCR*

“

*We are very impressed with the dimensional consistency of the equipotential insulators, and we never got to imagine completely that such tolerances were possible.*

*Henry Salomon De Friedberg,  
Compania Minera Quebrada  
Blanca S.A. / Teck*

# Meet the team

## Headquarter (Canada)



Member of the Quebec Order of Engineers (OIQ) and President of Pultrusion technique. He is an innovator with more than 25 years of experience in fiber-reinforced composites (FRP) as well as in the pultrusion process, and has an enviable portfolio of 16 patents which are testimony to his leadership in the industry.

**Robert P. Dufresne, P. Eng.**



Structural engineering specialist with over 14 years of experience in finite element analysis and design of steel, concrete and composite structures. Award winner research engineer and author of several scientific papers in international journals and conferences.

**Hamid Arabzadeh, PhD, P. Eng.**



Mechanical engineer from Polytechnique Montreal and member of Order of Engineers (OIQ). With over 4 years of experience in mechanical engineering, composites manufacturing and metrology, he contributes to the developments of production process aiming at the best quality products.

**Simon Balit-Achim, P.Eng.**



Master's degree in EMBA, from École de technologie supérieure (ÉTS University). With more than 10 years of experience as a plant manager at Pultrusion technique, he is familiar with different composite materials properties and their applications.

**Xavier Dufresne, MBA.**



Executive assistant with more than 30 years of experience in administration, she acquired a wide range of skills and diversified experiences that allow her to provide support in management of the operational elements of the direction, and to serve as a liaison to the President for both internal and external needs.

**Christine Ancil**



## Latin America

Professional with extensive experience and knowledge in executive assistance, administration, event planning, foreign trade, logistics and coordination management, focused on the mining area in Latin America

**Elizabeth Fadic**

  
*Pultrusion technique inc.*



## THE TEAM

We work as a team, cooperate closely and acknowledge everyone's contribution; and we encourage and value innovative ideas to maintain our high standard of excellence

Our positive and constructive relationships with all our employees and partners are based on mutual trust and respect. We have an unwavering commitment to staying true to our entrepreneurial culture and our values.

We strive for excellence in everything we do, as well as in our relations with clients, suppliers and colleagues.



Thank you



PULTRUSION  
Mining