It was a feat of materials engineering when Fabricated Plastics Limited (FABCO), Toronto, built electrolytic cell housings of Tefline® Armourplastic® (FRP and glass-backed FEP) for a sodium chlorate plant outside Montreal – the first complete cell house equipped with cells made from this combination of materials anywhere in the world.

Some electrolyzer cells are made of metal. (A combination of mild steel and titanium is normally used.) For bi-polar cells, however, non-conducting materials have to be used. These are plastics which need to be carefully engineered to give the necessary corrosion resistance as well as be sufficiently rigid to prevent deflection in the walls.

“Non-conductive ‘Armourplastics®’ (a thermoplastic liner bonded to an external FRP armouring) with their excellent corrosion resistant qualities are obvious materials to use in place of titanium and steel,” says Greg Landry, VP Sales of FABCO. However,

A total of 25 electrolytic cell housing were built by FABCO for the Quebec plant.
the highest operating efficiency is achieved with process temperatures that are too high for either straight FRP or PVC/FRP combination.”

The solution to the temperature problem was to build the cell housings with an inner liner of glass backed Teflon - which will resist virtually all corrosive chemicals, even at high temperatures - bonded to an outer armouring of FRP.

The FRP provides strength and rigidity as well as additional protection against the corrosive solution inside if, for any reason, it might permeate the liner.

(The 60 and 90 mil [2.4 & 3.5"] thick FEP lining material is called Armalon®, made by E.I. du Pont de Nemours in the U.S. The FEP is a thermoplastic fluorocarbon resin.)

The marriage of the two materials (FRP and Armalon) promises to provide greater safety in the plant and increased efficiency - the latter as a result of the higher operating temperatures sustainable with Armalon.

FABCO built 25 of the cell housings for the Quebec plant to produce 25,000 metric tons per year of sodium chlorate.

Because of the large dimensions of the cells and size limitations of the Armalon®, each cell housing had to be made in three parts. The Armalon® liners were shaped on steel molds and welded together to form the cell lining.

All three sections are flanged to permit them to be bolted together in one housing.

The outer armouring of FRP was applied to the outside of each liner by hand layup to provide mechanical strength.

The biggest challenge in using plastics for the cells was to control wall deflection to not more than 3 mm (0.118 in.) under full load.

FABCO engineering department devised the solution to the deflection problem by girdling each tank with six rectangular steel tubes which were bonded to the FRP during layup.

Because steel and FRP have different coefficients of expansion, however, FABCO had to work out a complicated method of bonding the two materials together with special resins.

Another important requirement was to ensure the flanges on the cover, middle section and bottom section were perfectly flat to ensure leak-tight seals when the three components were bolted together. Each cell is approximately 2.7 m (9 ft) long, 1.2 m (4 ft) wide and 4.9 m (16 ft) high with rounded corners.

FABCO selected a vinyl ester resin specially formulated to avoid “curl-back” at the faces of the flanges - a flexible resin which will resist stresses without cracking.

Key areas of the production line piping are Armalon®-lined FRP made by hand layup FRP "arming" it with strong FRP FRP.

Because every flanged joint is a potential "leaker", FABCO assisted the customer by designing the system with a minimum of flanges.

To speed up the installation of the piping, FABCO used Vanstone flanges to make mechanical field joints instead of employing full-face flanges. (The Vanstone has two steel rings which are bolted together to hold the two faces of the flange together.)

Approximately 61 m (200 ft) of piping was supplied by FABCO. It ranges from 8 to 16 in. (203 to 406 mm) in diameter.

The customer, supplies sodium chlorate to pulp and paper mills in Quebec, Nova Scotia, New Brunswick and the northeastern U.S.

The new electrolytic processing cell construction is the first of its kind. The FEP/FRP laminate provided both the corrosion and temperature resistance needed to maximize production efficiency, and the nonconductive materials eliminated potential electrical hazards. None of the FEP linings have failed since the original 25 cells were originally installed.

Although the FEP-lined cells were nearly three times the cost of traditional rubber-lined steel cells, they have already provided decades of minimal-maintenance service. Since the traditional rubber liners lasted only a few years, the cost savings are significant.

The pulp and paper industry has been using more and more sodium chlorate over the years because it produces a brighter pulp with stronger fibers and poses fewer environmental problems than chlorine or sodium hypochlorite. The sodium chlorate plant which has expanded several times using cells of the same design and materials and currently produces over 100,000 metric tons per year.

FABCO has sold a similar system employing the same Tefline® Armourplastic® material to a Vancouver engineering firm for installation in a sodium chloride plant in Nanaimo, B.C. In addition, FABCO has supplied cylindrical configuration cells to a new sodium chlorate plant in Washington state.

Cylindrical cell housing FEP lined, fusion welded seams throughout.