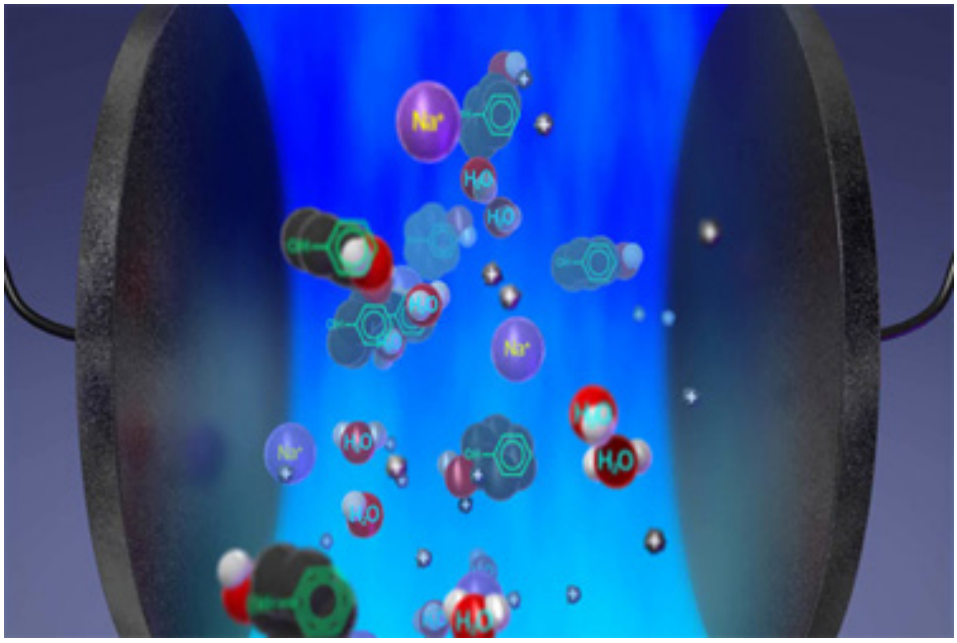
SIEMENS energy

A Cost-Effective Solution To Purposeful Propylene Production

As a popular chemical building block, propylene is used in downstream petrochemical processes to make a number of important materials, including polypropylene, one of the best-selling plastics, as well as material that is used to produce items such as acrylic fibers and coatings, polyurethanes, and isopropyl alcohol.

While the global demand for propylene is rising, less of the chemical is being generated through traditional means as a byproduct of crude oil refining. The growing gap between propylene supply and demand is a result of both a softening fuel market and a shift toward shale oil, which generates less propylene by nature. This has led to an increase in purposeful propylene production in both the U.S. and Canada.



Courtesy of Siemens Energy

Caustic used as a neutralizing agent in that manufacturing process eventually becomes waste material, known as spent caustic, which is too toxic to send into the wastewater stream and must be treated first.

The problem with using conventional caustic treatment processes for purposeful propylene production — such as wet air oxidation, or WAO, which is commonly used for ethylene production — is that spent caustic generation occurs on a much smaller scale and is therefore too capital-intensive. For instance, ethylene production may have a spent caustic processing flow rate of 10 to 50 gpm, whereas propylene is likely in the 1 to 5 gpm range.

However, cost-effective options are now available to treat spent caustic for propylene at those lower flow rates.

Behind The Technology

Electro-oxidation has proven to be highly effective at treating spent caustic, like that generated in propylene production, but until recently the technology wasn't financially feasible because electrode materials were not efficient enough and had a short lifespan. Through a partnership with De Beers, an international diamond producer, Siemens Energy now has the ability to use the latest developments in free-standing, electrically conductive synthetic diamonds to offer a system that has a long electrode life.

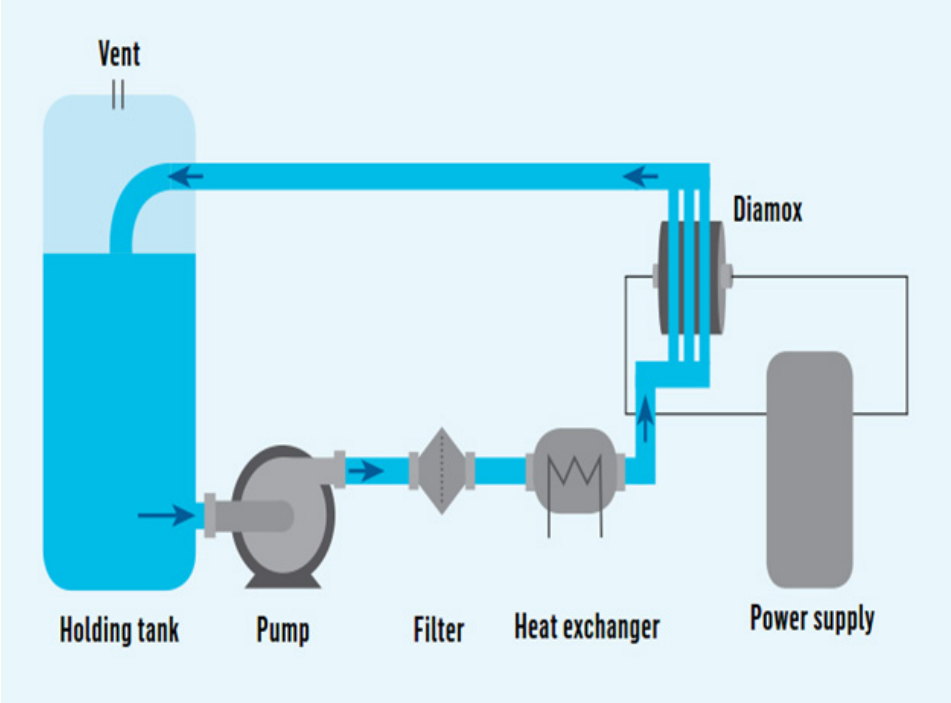
Not only does the diamond hold up extremely well to very corrosive fluids, but it also allows the use of high-current densities, allowing for smaller electrode areas and thereby lowering cost.

Siemens Energy's Zimpro® electro-oxidation process, also known as ZEO, requires only electricity, cooling water, and instrument air for operation. The oxidation reactions are performed by hydroxyl radicals formed on the surface

of the electrode when current is applied. The hydroxyl radicals rapidly oxidize and destroy the contaminants in the spent caustic as it is pumped through the reactor.

An important requirement for the ZEO process to work properly is that the treatment stream be electrically conductive. With salt concentration greater than 3 percent, spent caustic is highly conductive and typically includes contaminants such as sulfides, mercaptans, phenols, cresylates, and naphthanates, although those are all easily destroyed during the ZEO process.

Using the ZEO process for propylene production does create hydrogen as a byproduct and, because there typically isn't enough hydrogen to make capturing it worthwhile, gas handling measures need to be implemented to ensure safe disposal. However, in propylene production facilities where hydrogen is already present, the off-gas from the ZEO system can be fed into the existing gas stream. This makes the ZEO solution even more economical because there is no ongoing cost to neutralize the hydrogen byproduct.



Courtesy of Siemens Energy

The Business Case

Siemens Energy packages the ZEO system into compact, user-friendly modules that are skid-mounted. They can simply be dropped onto a concrete pad, hooked up, and started. Because of its relatively low capital and operating costs, compared to WAO, there is a strong business case for investment. For instance, ZEO can be as low as a quarter of the cost of a custom WAO investment. Because the solution is turnkey, leasing is also a viable option.

Three different sizes of oxidation capacity are available to meet the demands of any specific application. And in some cases, the capacity of a ZEO system can be easily increased without major modifications. For those applications that fall in between the larger scale of a custom WAO system and the smaller scale of ZEO technology, Siemens Energy offers a small, turnkey WAO system that would cost less than a third of the price of a custom, larger-scale WAO system.

These more advanced treatment options from Siemens Energy provide propylene manufacturers a strong tool for maximizing profits. ■