Using the Active Component Concentration Profile to Control Electrochemical Water Treatment Process

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Background

Power producers worldwide are exploiting new technologies in water and wastewater treatment. One of the promising new technologies is the electrochemical wastewater treatment and the process water deionization. Reason: Power plants could purify the water without the cost, space, safety and environmental issues associated with the treatment chemicals. On an equivalent basis, electrons are cheaper than most of the oxidizing or reducing agents used stoichiometrically. Another important feature of an electrochemical treatment is that in addition to solving an environmental problem, it is often possible to recover chemicals and metals from process streams in salable or reusable forms.

The trick in applying electrochemistry is making it practical for water treatment, particularly for very dilute solutions. The key elements to making an effective process are high mass-transfer rate and efficient current control.

Minit-Charger® Opportunities

Fundamentally similar processes are occurring during fast battery charging. Figure 1 represents the active component concentration profile as measured by the process controller. Mass is transferred between the electrodes, where an electrochemical reaction is taking place. Our Minit-Charger® control process is designed to constantly monitor the concentration of active species at the plate surface, and adjust the current flow accordingly so that the mainstream reaction rate is maximized while the unwanted side reactions are minimized. The concept has been proven effective with any battery chemistry and the same principle could be applied to electrochemical water treatment. Active current control would ensure the highest possible reaction rate, while maintaining high process efficiency.

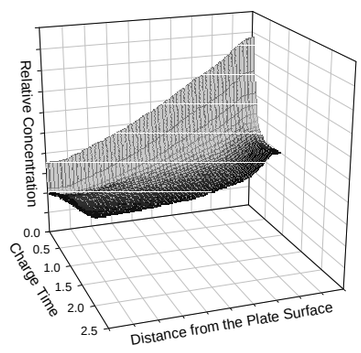

Figure 1. Active Component Concentration Change Inside the Boundary layer

The advantage of this method, with it's active process control and high accuracy, is it's universal applicability to any electrochemical process where it is necessary to control the rate of reactance mass transport and plate surface morphology. The principal benefits are:

- Current would be instantly adjusted to match the detected concentration of active components
- Control algorithm could be used to achieve the highest reaction rate and process efficiency over the entire concentration range
- Existing high-power technology and processor-based control would be applicable
- Low gassing associated with the Minit-Charger® system would effectively increase the mass transfer rate