

### An Investigation of the Performance of the HI Concentration by Electrodialysis Cell for Hydrogen Production in Sulfur Iodine Process

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The performance of HI concentration over HIx solution by polymer electrolyte membrane electrodialysis was investigated in terms of water transport, cell voltage, and operation limit. For this purpose, the electrodialysis cell was assembled with Nafion 117 as a PEM membrane and two activated carbon papers as the electrodes. HIx solution was prepared with composition of HI: I<sub>2</sub>: H<sub>2</sub>O = 1: 0.5~2.5: 5.2 in molar ratio. The cell and its peripheral apparatus were placed in the specially designed convective oven in order to uniformly maintain the operation temperature. The cell voltage was measured by applying constant current of 2A to the cell and resulting water transport was calculated on the basis of composition analysis after the experiment.

As operation temperature increased, the amount of water transport from anode to cathode increased, thus reducing HI molarity in catholyte. Meanwhile, the current efficiency was constant as about 90 %, irrespective of temperature change. The cell voltage increased with initial I<sub>2</sub> mole ratio as well as anolyte to catholyte mole ratio. Moreover the cell voltage overshoot took place within 10 h cell operation, which is due to the I<sub>2</sub> precipitation inside the cell. From the analysis of I<sub>2</sub> mole ratio in the anolyte, it is noted that operation limit (in I<sub>2</sub> mole ratio) of the electrodialysis cell, arising from was measured to be 3.2, which is much lower than bulk solubility limit of 4.7.

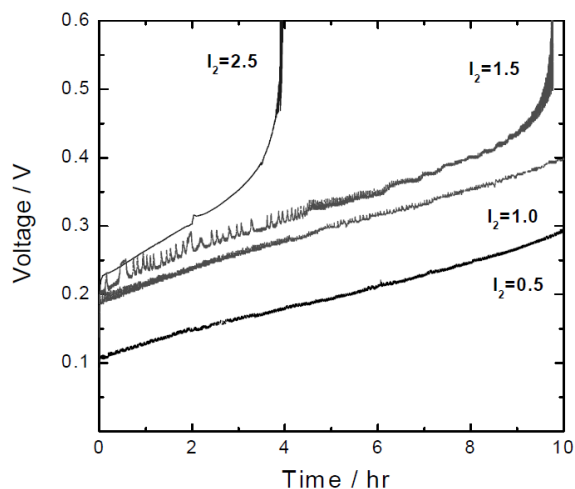


Fig. 1 Plots of cell voltage versus time measured from the electrodialysis cell with various I<sub>2</sub> compositions at 80°C. The initial composition of HIx solution was HI: I<sub>2</sub>: H<sub>2</sub>O = 1: 0.5~2.5:5.2. The initial mole ratio of anolyte to catholyte was 2.0 (HI mole in catholyte : 0.89)

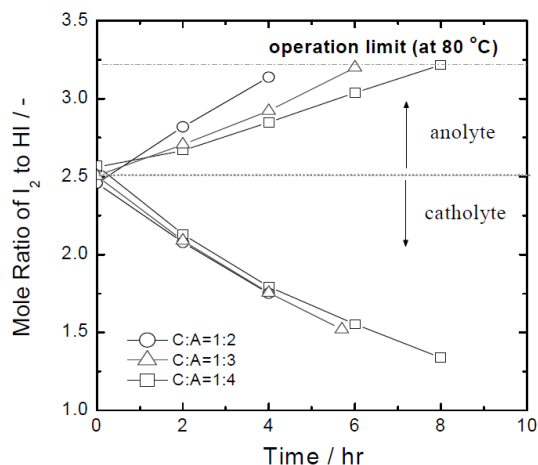


Fig. 2 Plots of mole ratio of I<sub>2</sub> to HI versus time measured from the electrodialysis cell with various initial mole ratios of anolyte to catholyte at 80°C. The initial composition of HIx solution was HI: I<sub>2</sub>: H<sub>2</sub>O = 1: 2.5: 5.2. The initial HI mole in catholyte was 0.89