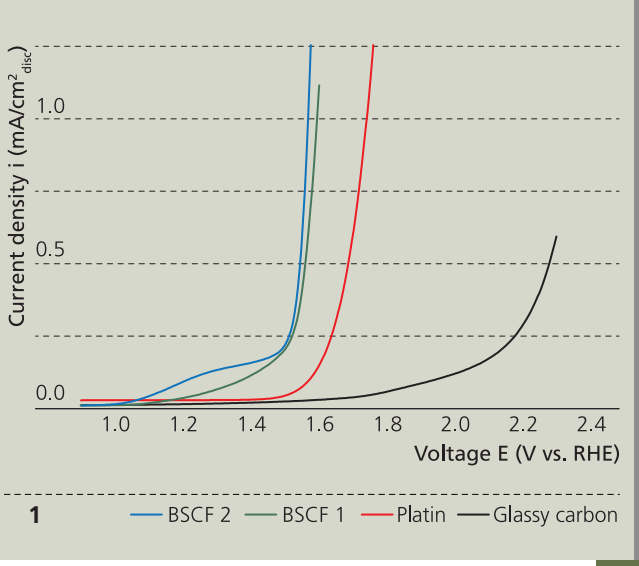

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ELECTROCATALYSTS FOR IMPROVING THE EFFICIENCY OF ALKALINE WATER ELECTROLYSIS

Dr. Benjamin Jäger, Dr. Ralf Kriegel

The extensive use of renewable energy leads to fluctuating feed-in of energy to the grid, giving rise to a need for highly efficient storage of excess energy. Conversion into chemical energy is especially suitable for long-term storage. Water electrolysis is a promising process in the context of "power-to-gas" strategies.

The electrolysis process efficiency is proportional to the cell voltage and directly influences the overall storage process efficiency. All real electrolysis units suffer from overpotential in both the anode and the cathode reaction, with the four-electron anode reaction having the highest overpotential. Electrocatalysts can significantly lower the required cell voltage. Thus, use of inexpensive electrocatalysts offers great potential for increasing efficiency.

Figure 1 shows the decomposition voltage in alkaline water electrolysis without a catalyst (glassy carbon = catalyst support) as well as for platinum and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (BSCF)-coated electrodes. As the voltage was being raised, a substantial current flux already occurred below the theoretical decomposition voltage of 1.23 V. This was due to oxidation of Fe/Co in the BSCF catalyst. With respect to the oxygen evolution reaction, the required voltage was observed to approach the expensive platinum catalyst level (shift to the left).

During use under alkaline water electrolysis process conditions, the cell voltage reduction amounted to ca. 100 mV by using an electrode as shown in Figure 2 at a current density of 1500 A/m², corresponding to an efficiency increase of 4 %. Through adaptation of the coating process, a cell voltage reduction of 300 mV at a current density of 5000 A/m² was achieved in the electrolysis test rig using an electrode. This yielded an efficiency increase of 12 % over that of the standard setup without electrocatalysts. Furthermore, the applied coating was chemically and electrochemically stable.

Services offered

- Development of electrocatalysts
- Electrocatalytic activity measurements
- Coating of electrodes

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1 *Linear sweep voltammograms of two BSCF electrocatalysts versus platinum.*
2 *BSCF electrocatalyst-coated electrode.*

Contact Benjamin Jäger • Phone +49 36601 9301-1830 • benjamin.jaeger@ikts.fraunhofer.de