

# QSI-Nano<sup>®</sup> NiFe Product Profile

## Hydrogen Generation Electrodes

### Nano NiFe Cathode Electrodes for Water Electrolysis

QSI-Nano<sup>®</sup> NiFe alkaline water electrolysis electrodes are manufactured using a process in which a blend of highly catalytic QSI-Nano<sup>®</sup> nickel and iron particles are functionalized by dispersing into a proprietary formulation, spray coated, and sintered onto a stainless steel (SS) substrate. The resulting electrodes have an increased surface area of approximately 1000 times vs. standard SS metal plates and may be used as a drop-in solution for existing alkaline electrolyzers to achieve the following results:

- Increased Gas Output
- Decreased Energy Consumption
- Decreased Size While Maintaining Efficiency

**Prices (Includes Two 16 Gauge 316 SS Electrodes, Nano NiFe Coating on One Side Only)\***

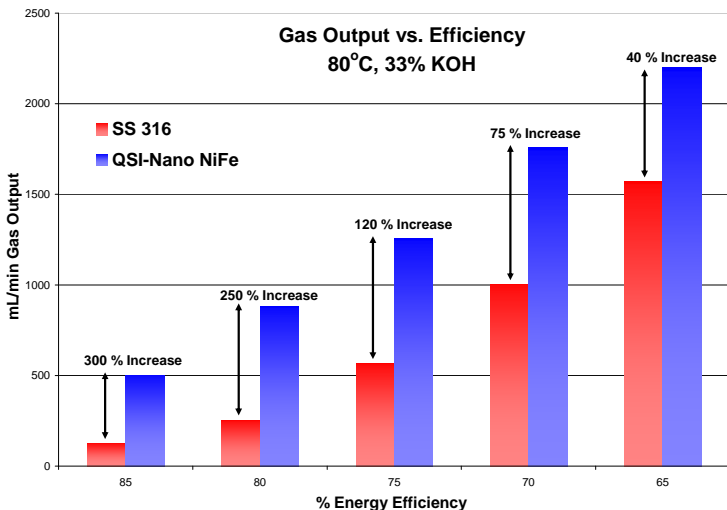
|         |          |
|---------|----------|
| 2" x 2" | \$ 99.00 |
| 4" x 4" | \$149.00 |
| 6" x 6" | \$189.00 |

\*Customization and special pricing available on orders over 100 pieces. Prices subject to change.

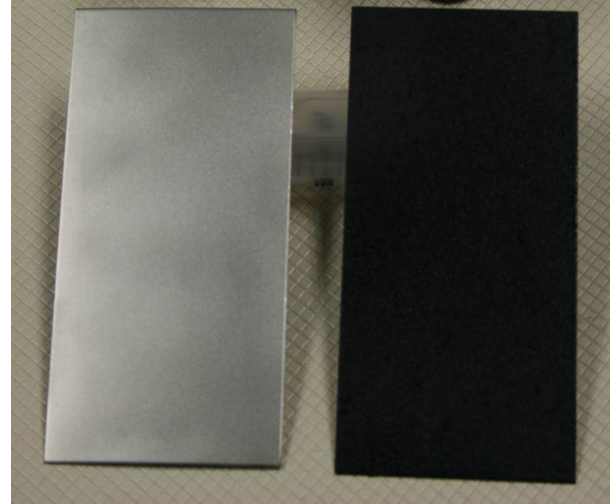
To Place an Order Go To: <http://www.qsinano.com/order.php>

**Note:** Typical operating conditions are 80°C, using 33% KOH electrolyte in DI water. Nominally, gas production rates are increased 2 - 3 times the typical values at a given efficiency (higher current at same voltage). The gas output graph below compares SS electrodes (red) vs. a SS anode and QSI-Nano<sup>®</sup> NiFe coated cathode (blue) in a 20A, six-cell stack with 12V limiting voltage. Performance may vary based on operating conditions and system design.

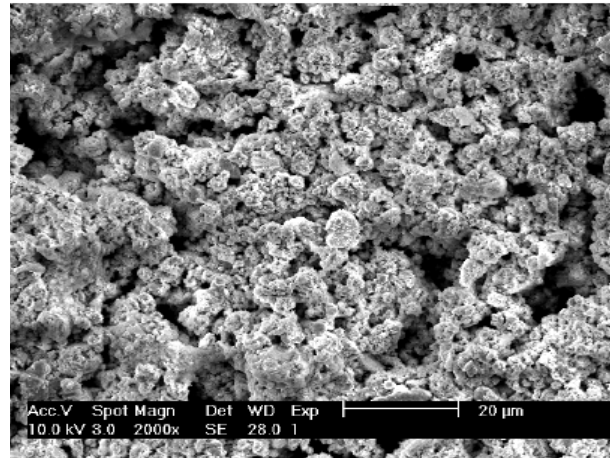
### Typical Gas Output Vs. Energy Efficiency



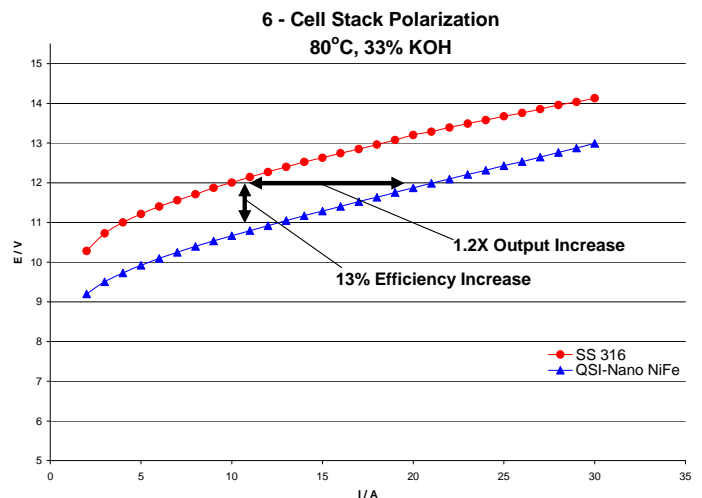
SS Electrode (left), QSI-Nano<sup>®</sup> NiFe Coated Electrode (right)

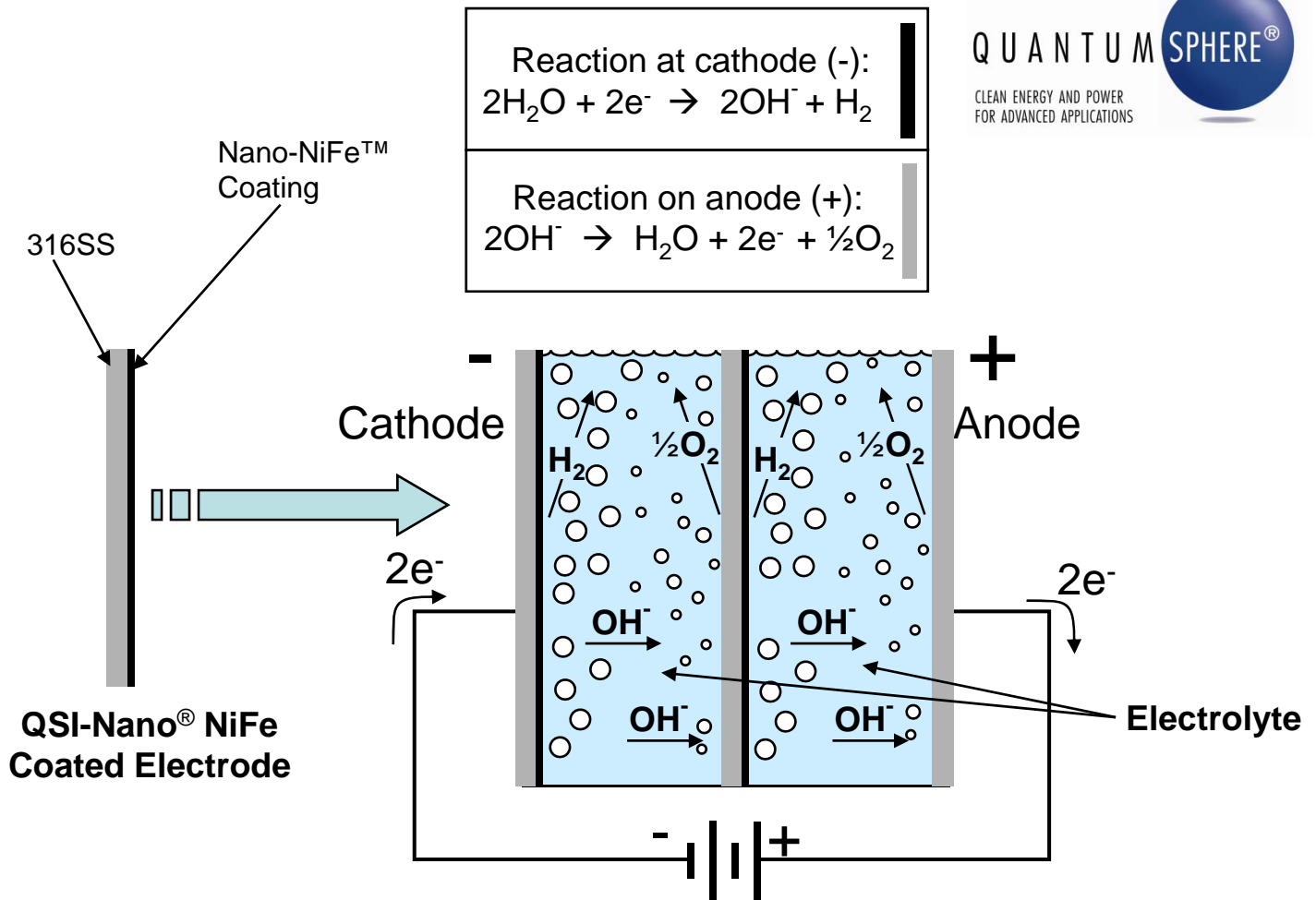


SEM Image of QSI-Nano<sup>®</sup> NiFe Coated SS Electrode Surface



### Polarization Curve of SS (red) Vs. QSI-Nano<sup>®</sup> NiFe Coated SS (blue)





## Alkaline Electrolyzer with QSI-Nano® Electrodes - Bipolar Stack Configuration -

### Recommendations for Using QSI-Nano® NiFe Coated Electrodes in Water Electrolysis

**Electrolyte:** Alkaline, preferably 33 wt% potassium hydroxide (KOH) in distilled water.

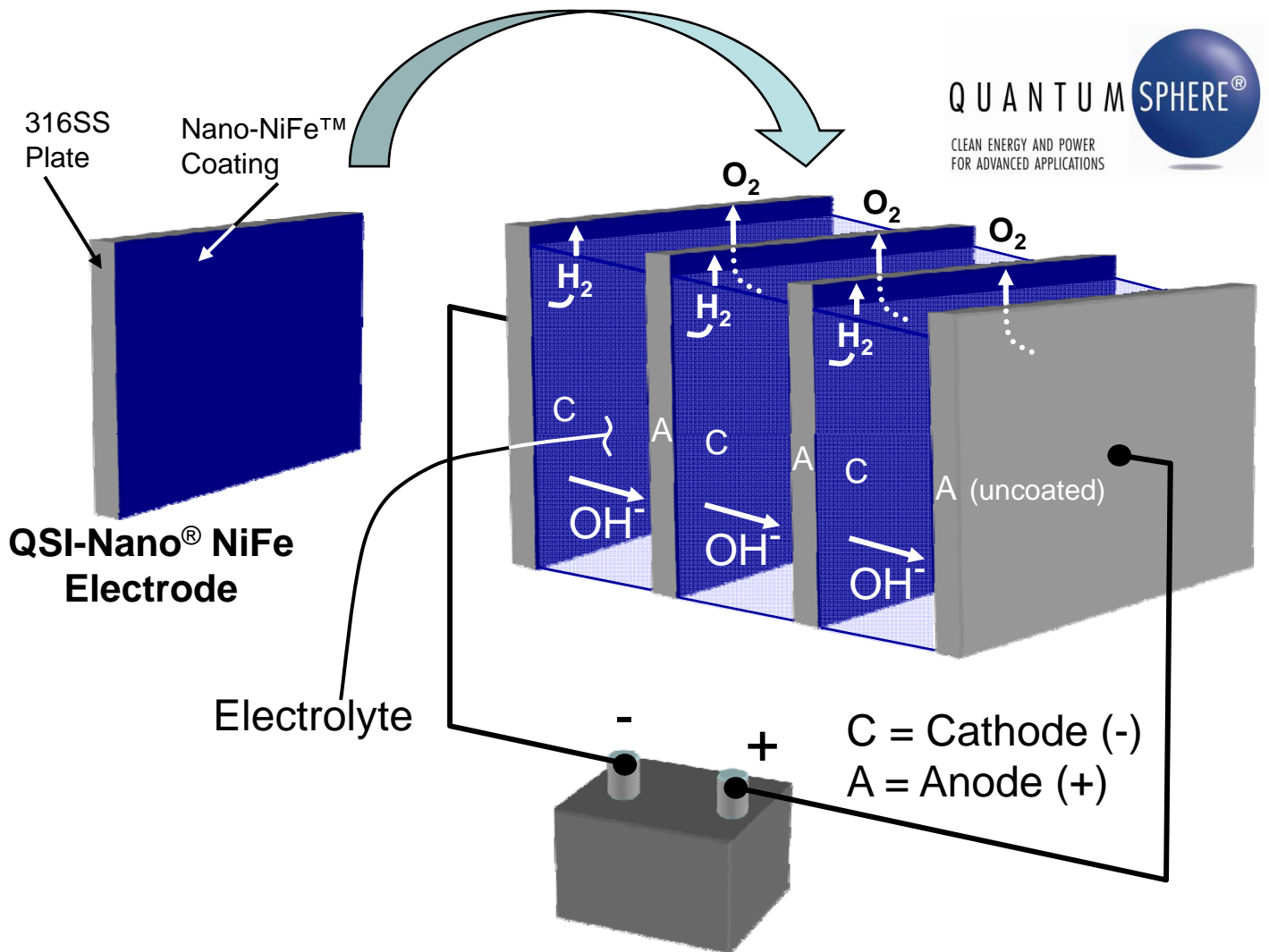
**Water makeup supply:** Distilled water

**Electrode spacing:** 0.375" or less. Spacing should be small enough to minimize resistance from electrolyte, yet not too small where the  $\text{H}_2$  and  $\text{O}_2$  bubbles increase resistance from obstruction of ion current.

**Operating temperature:** Maximum of 80 °C. (176 °F). Electrolyte resistance decreases with increasing temperature, so electrolysis becomes more electrically efficient with increasing temperature.

**Voltage/Current:** Voltage will typically be a little above 2V per cell and decrease to below 2V as temperature increases from room temperature to 80 °C (176 °F). A current density range from a few  $\text{mA}/\text{cm}^2$  through 500  $\text{mA}/\text{cm}^2$  is acceptable. The specific voltage/current behavior strongly depends on cell and stack design.

**Note:** The nano coated side of the electrode is the cathode (negative, hydrogen producing) electrode, and in a bipolar stack arrangement must be facing the adjacent anode as shown in the figure. This polarity is important for correct operation of the electrodes. In a single cell arrangement, simply ignore the middle electrode in the figure.



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