CLAIMS:

1. A method comprising:

reforming a gas stream in a reactor, the gas stream including hydrocarbons, using a treated catalyst metal to convert at least a portion of the hydrocarbons to hydrogen in the gas stream;

periodically treating, while reforming the gas stream, the catalyst metal in a reducing gas mixture environment within the reactor, wherein the reducing gas mixture comprises hydrogen and at least one sulfur-containing compound, wherein the at least one sulfur-containing compound includes one or more of a hydrogen sulfide, a carbonyl sulfide, a carbonyl disulfide or an organic sulfur-containing compound, wherein periodically treating the catalyst metal while reforming the gas stream includes treating the catalyst metal with a total sulfur dose per treatment by periodically adding the sulfur-containing compound to the reactor with the gas stream, wherein the total sulfur dose per treatment is determined by a sulfur level in the reducing gas mixture and exposure time of the catalyst metal to the reducing gas mixture during the treatment, wherein the total sulfur dose per treatment is such that there is a decrease in a rate of deactivation of the catalyst metal during the reforming of the gas stream compared to the rate of deactivation of the catalyst metal not treated with the total sulfur dose; and

supplying the reformed gas stream to the fuel side of a solid oxide fuel cell stack to generate electricity via an electrochemical reaction using the reformed gas stream as a fuel source, wherein a concentration of sulfur in the reducing gas mixture during each treatment is between approximately 5 parts per billion volume (ppb-v) and approximately 200 ppb-v.

2. The method of claim 1, wherein treating the catalyst metal comprises heating the catalyst metal, within the reactor, to a temperature between approximately 350 to 1,200 degrees Celsius in the reducing gas mixture environment.

3. The method of claim 1, wherein reforming the gas stream including the

hydrocarbons using the treated catalyst metal comprises steam reforming the gas stream including the hydrocarbons using the treated catalyst metal.

4. The method of claim 1, wherein the catalyst metal comprises one or more of Ni, Co, Rh, Ru, Pd, Pt or Co.

5. The method of claim 1, further comprising:

detecting, between periodic treatments of the catalyst metal, an increase in a rate of deactivation of the treated metal catalyst while reforming the gas stream using the treated catalyst metal; and

re-treating the catalyst metal with the total sulfur dose in the reducing gas mixture environment based on the detection.

6. The method of claim 1, wherein the total sulfur dose is such that the rate of conversion of the hydrocarbons to hydrogen is decreased less than approximately 1 percent during the reforming of the gas stream compared to the rate of deactivation of the catalyst metal when not treated with the total sulfur dose.

7. The method of claim 1, wherein the decrease in the rate of deactivation of the catalyst metal is at least 30 percent compared to the rate of deactivation of the catalyst metal not treated with the total sulfur dose.

8. The method of claim 1, wherein the total sulfur dose per treatment is from about 100 parts per billion hour (ppb-h) to about 5000 ppb-h.

9. The method of claim 1, wherein sulfur concentration within the reactor during a periodic treatment is from approximately 0.02 part per million volume (ppm-v) to approximately 0.5 ppm-v.

10. The method of claim 1, wherein the gas stream comprises a natural gas stream,

wherein the natural gas stream fed to the reactor during each periodic treatment includes the at least one sulfur-containing compound for treating the catalyst metal with the total sulfur dose.