COLORADOSCHOOLOFMINES
engineering the way

Impedance-Based Sensor for Detection of Catalyst Coking in Fuel Reforming Systems

Jeffery L. Wheeler, Jason M. Porter, and Neal P. Sullivan

Summary: A novel sensor for detecting the early stages of catalyst coking in fuel reforming systems

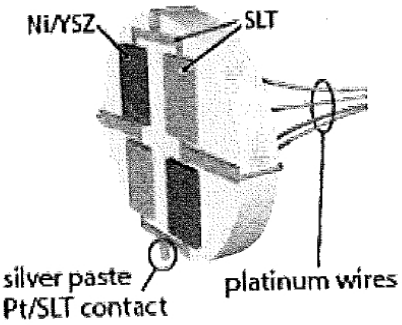
Description: A novel sensor for detecting the early stages of catalyst coking in fuel reforming systems has been developed. The sensor was manufactured by inkjet printing a colloidal suspension of ceramic powders to create thin (20 µm) catalytic and conductive elements of the sensor. The catalytic elements of the sensor are composed of a Ni-YSZ cermet. The Ni-YSZ cermet was prepared with a concentration below the percolation limit (20 vol%) of nickel, ensuring a low electrical conductivity. As coke forms on the catalyst material, the nickel nodules in the Ni-YSZ are connected by electrically conductive carbon and the conductivity of the catalyst material increases. The sensor was tested in a 1% ethylene environment to induce coking. The sensor showed a strong response to coking by producing a signal on the order of hundreds of millivolts. The mass of the coke load was determined to be below the detection limit of available thermogravimetric analyzers (TGA) (<10 µg). The coke load was further examined with a field effect scanning electron microscope (FESEM) and was found to be primarily filamentous carbon. Carbon lament 10-50 nm in diameter connected nickel nodules in the sensors catalyst material resulting in a change in resistance in the catalyst material.

Main Advantages of this Invention:

- Low manufacturing cost using readily available materials
- Monitors coking in real time

Potential Areas of Application:

- Solid oxide fuel cell systems using hydrocarbon fuels
- Steam methane reforming to produce hydrogen



ID number: # 13012

Intellectual Property Status: US utility application pending (#14/245,341).

Opportunity: We are seeking an exclusive or non-exclusive licensee for marketing, manufacturing, and sale of this technology.

For more information contact:
William Vaughan, Director of Technology Transfer
Colorado School of Mines, 1500 Illinois Street, Guggenheim Hall Suite 314, Golden, CO 80401
Phone: 303-384-2555; e-mail: wvaughan@mines.edu