 Detection of Carbon Monoxide Using Polymer-Carbon Composite Films

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A carbon monoxide (CO) sensor was developed that can be incorporated into an existing sensing array architecture. The CO sensor is a low-power chemiresistor that operates at room temperature, and the sensor fabrication techniques are compatible with ceramic substrates.

Sensors made from four different polymers were tested: poly-(4-vinylpyridine), ethylene-propylene-diene-terpolymer, polyepichlorohydrin, and polyethylene oxide (PEO). The carbon black used for the composite films was Black Pearls 2000, a furnace black made by the Cabot Corporation. Polymers and carbon black were used as received. In fact, only two of these sensors showed a good response to CO. The poly-(4-vinylpyridine) sensor is noisy, but it does respond to the CO above 200 ppm. The polyepichlorohydrin sensor is less noisy and shows good response down to 100 ppm.

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Substituted Quaternary Ammonium Salts Improve Low-Temperature Performance of Double-Layer Capacitors

Low cell resistances are observed when used with modified acetonitrile electrolyte blends.

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Double-layer capacitors are unique energy storage devices, capable of supporting large current pulses as well as a very high number of charging and discharging cycles. The performance of double-layer capacitors is highly dependent on the nature of the electrolyte system used. Many applications, including for electric and fuel cell vehicles, back-up diesel generators, wind generator pitch control back-up power systems, environmental and structural distributed sensors, and spacecraft avionics, can potentially benefit from the use of double-layer capacitors with lower equivalent series resistances (ESRs) over wider temperature limits. Higher ESRs result in decreased power output, which is a particular problem at lower temperatures. Commercially available cells are typically rated for operation down to only –40 °C.

Previous briefs [for example, “Low Temperature Supercapacitors” (NPO-44386), NASA Tech Briefs, Vol. 32, No. 7 (July 2008), p. 32, and “Supercapacitor Electrolyte Solvents With Liquid Range Below –80 °C” (NPO-44855), NASA Tech Briefs, Vol. 34, No. 1 (January 2010), p. 44] discussed the use of electrolytes that employed low-melting-point co-solvents to depress the freezing point of traditional acetonitrile-based electrolytes. Using these modified electrolyte formulations can extend the low-temperature operational limit of double-layer capacitors beyond that of commercially avail-