Technology Summary: Alcohol Gas Sensor

Opportunity Statement

Road traffic injuries are a leading cause of death around the world. In the US, one third of all road accident fatalities are due to alcohol-impaired driving. There is great public concern regarding drunk driving, and a new highway bill pending before the US Congress would instruct all 50 states to require motorists convicted of driving under the influence of alcohol to equip their cars with an interlock system[1]. (An interlock system is a device that would shut down the vehicle when a specific amount of alcohol is detected[2].) The personal breath analyzer market, currently valued at US200 million, is expected to grow rapidly as bills such as this are passed in multiple countries and as drivers become aware of the increased penalties for drunk driving.

Alcohol gas sensors are devices that can measure concentrations of alcohol gas over a specified range. They have applications in personal breath analyzers, interlock systems or even mobile phones[3]. Most alcohol gas sensors in the market can be classified into two categories:

1. **Semiconductor** gas sensors utilize small, heated (350-450 °C) beads of a transition metal oxide, across which a voltage is applied to produce a small standing current. The conductivity of the beads is dependent on the alcohol gas concentration and the alcohol level is thus determined by measuring the resistance across the beads.

2. **Electrochemical** gas sensors are based on electrochemical reactions in which alcohol in the gas phase is oxidized on a catalytic electrode surface to generate a quantitative electrical response. The electrical response is then used to determine the alcohol gas concentration. The manufacturing process of an electrochemical gas sensor is relatively more complicated (and thus more costly) than that of a semiconductor gas sensor.

Semiconductor gas sensors, although having lower sensitivity and specificity than electrochemical gas sensors, have a higher potential for mass adoption due to their lower cost (*up to 10 times lower*). The main issues with semiconductor gas sensors result from the use of sensing materials (e.g., SnO_2, ZnO or Fe_2O_3), which have several flaws including high operating temperatures, high energy consumption, low sensitivity and selectivity to ethanol. Although a noble metal catalyst can be added to improve performance, it also increases manufacturing costs and can reduce the operating life of the sensor.

Therefore, there is a need for a low-cost semiconductor gas sensor that overcomes the shortcomings of existing sensing materials to address the needs of the market.

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360ip's Partner Solution

The technology developed by 360ip's partner provides an improved semiconductor alcohol gas sensor through the use of a novel sensing material. The sensing material is comprised of cadmium sulfide-coated carbon nanotubes, and it is compatible with existing semiconductor alcohol gas sensor manufacturing processes.

The partner's alcohol gas sensor provides the following advantages:

- High sensitivity (S=Ra/Rg) value of 6 @ 50-100 ppm
- High specificity with no response to hydrogen sulfide/methane/ammonia/hydrogen/acetone/ benzene/methylbenzene at 1000ppm
- Low heating temperature of 250 °C
- Low heating voltage of 4.5V
- Fast response time of 10s

Patents

360ip's partner has one pending patent on this novel sensor technology.

360ip is seeking interested parties for the licensing, further development and commercialization of this technology-based solution.

For additional information, contact:
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[1] http://www.time.com/time/business/article/0,8599,1907493,00.html?iid=digg_share

[2] http://interlockfacts.com/pdfs/090724_ABI_AlcoholDetectionTech_PresentandFuture.pdf

[3] http://www.mobilemag.com/2005/10/26/lg-cell-phone-with-breathalyzer-gaining-popularity/