Selective and stable metal oxide gas sensors for ppb measurement of O₃, NO₂ and NOₓ in ambient air.

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**Introduction**

- Two WO₃ based materials have been developed for sensing of ppb levels of O₃, NO₂ and NOₓ in air.
- The screen-printed film microstructure and cohesion have been tuned for sensitivity and stability by controlling ink formulation and firing temperature.
- The sensors are integrated into specific instrument designs developed to exploit and augment the WO₃ sensing performance to achieve a selective response to the target gas.
- The instruments were field tested and compared with reference ambient analyzers to examine instrument drift and cross-interferences.

**O₃ instrument**

The sensor is subjected to periodic zero flow conditions and temperature cycling. This compensates for sensor drift and cancels interferences from NO₂ and VOCs.

**NO₂ instrument**

A simple thermal scrubber removes effect of ambient ozone and a zero cycle compensates for sensor drift and interference effects from humidity and VOCs.

**NOₓ instrument**

The NOx instrument uses a similar design to the NO₂ system but with a combined thermal O₃ scrubber + >95% efficient NO→NO₂ converter.

**Field Data**

A three month study of the instruments was undertaken to assess selectivity and stability. The instruments were co-located at an Auckland Council Air Monitoring Site equipped with a TAPI 400E ozone photometer and a TAPI 200 chemiluminescence NOx analyzer. No zero or span adjustment of sensor instruments was performed. Difference plots (analyzer-sensor) showed low drift rates: O₃ (<1 ppb/month), NO₂ (<5 ppb/month), NOₓ (<2 ppb/month).

**Summary**

Instruments based on WO₃ semiconductor sensors have been successfully developed for selective measurement of ozone, nitrogen dioxide and NOx in the atmosphere. The instruments tracked reference analysers for periods of months, without recalibration, showing low levels of drift and cross-interference effects. They have proved capable of monitoring ambient air with reference analyzer level data quality.

**Future**

Fabricate O₃ scrubber and NO→NO₂ converter “on-chip”
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