

## Problem Set 7 Solutions

1.

Type	Potentiometric	Semiconducting (Bulk)	Semiconducting (Interfacial)	Resonant
<b>Selectivity</b>	Selective to only oxygen partial pressure, but many things can change that	Depends on semiconductor. Some materials are very selective while others are not. Arrays of sensors with different materials can be very selective (this is basis of “electronic noses”).		Depends on film, could be very good
<b>Aging</b>	Resistant to aging effects	Drastic partial pressures can reduce the semiconductor to the point of sensitivity loss	Grain growth can cause loss of sensitivity with age	Depends on film
<b>Cost</b>	Cheap	Avg.	Cheap	Expensive
<b>Response time</b>	Surface interaction (fast)	Diffusion of species throughout material (slow)	Surface interaction (fast)	Diffusion of species throughout film (avg.)
<b>Electrical Properties</b>	Need high ionic conductivity	Need high ionic conductivity. Need to be in electronic conduction regime	Need to be in electronic conduction regime	Need a piezoelectric material

2. A smart sensor might:

- integrate the actuator element (e.g. the window turns opaque when the temperature becomes high)
- combine the capabilities of an array of different sensors (e.g. combined oxygen sensor, vibration sensor and temperature sensor can together ‘sense’ auto engine performance)
- be integrated with information processing/communicating circuitry
- self-calibrate or auto-adjust with changing temperatures or environments
- predict future states to provide an advanced warning