# Selective gas sensor using porous silicon and silicon nanowires

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A very high surface to volume ratio makes both porous Si and Si nanowires very attractive candidates for gas, liquid, chemical and biological sensors. We report on comparative studies of gas sensing using Si nanowires and porous silicon. Using the impedance dependencies of both materials on frequency in the $10^3$–$10^5$ Hz range established unique signatures for ethanol, methanol, acetonitrile, chloroform and toluene vapors. The time response of both sensors is on the order of 1 to 50 sec. However, silicon nanowire sensor has a somewhat longer recovery period. The effect of gases on the $1/f$ noise characteristics is small. The sensor sensitivity is relatively small but better in Si nanowires. The porous silicon changes in impedance are more pronounced for the reactive component, whereas Si nanowires have significant changes in the frequency dependence of the active component, when exposed to a gas.

Both materials could work as viable selective gas sensors. However, their sensitivity to different gases is quite different, and their combination could be used for a superior selective gas sensor, as we have recently demonstrated. We have also proposed selectivity parameters that can be easily extracted from the changes in the impedance frequency dependence to establish identifiable gas signatures.