

Eliminating Flow Sensitivity in NexTech’s Hydrogen Sensor

NexTech Materials has developed a hydrogen sensor technology for lower flammability level (LFL) detection of hydrogen in air. Side-by-side testing of beta-prototype sensors with commercially available hydrogen sensors uncovered a strong dependence of gas flow rate on sensor output, in both the NexTech and competitive sensor products. Sensors designed for use in static environments overestimate hydrogen concentration in flow environments, yielding costly false positive responses. Those designed for use in gas flow streams dangerously underestimate hydrogen concentration in lower flow rate or static conditions. NexTech has used this information to design a sensor that will operate reliably and accurately over a wide range of flow conditions.

NexTech beta-prototype and commercially available hydrogen sensors were evaluated in laboratory testing over a wide range of flow rates. Figure 1 shows the normalized raw signal output of these sensors in response to 1% hydrogen in air, as a function of flow rate. As these data show, both the commercial and NTM beta-prototype sensors are significantly impacted by flow, resulting in erroneous indication of hydrogen if used in gas flows other than that at which they were calibrated.

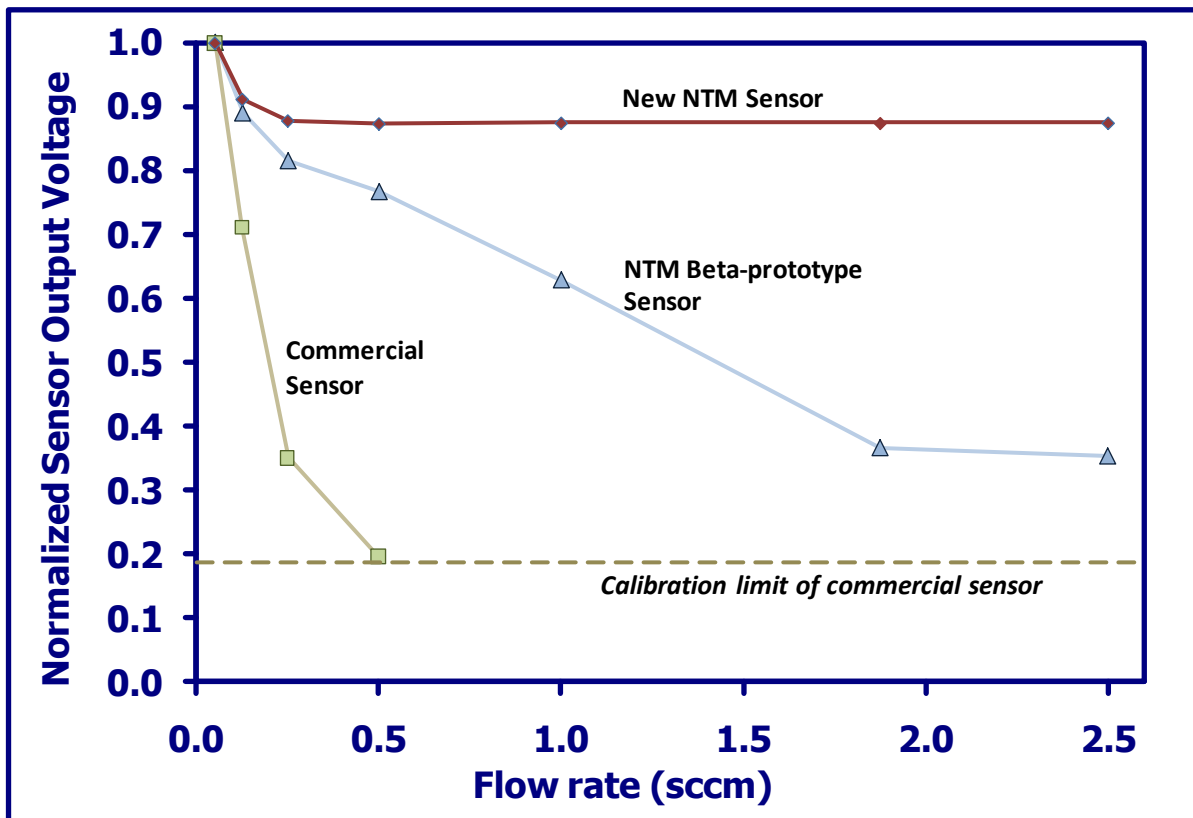


Figure 1. Flow sensitivity of the NTM beta-prototype sensor and commercial sensor. Commercial sensor pegs at its calibration limit at relatively low flow rates (0.5 cm/s).

In this testing, the commercial sensor matched its reported calibrated value at a linear flow rate of 0.25 cm/s. At higher flow rates, the sensor quickly saturated at its maximum output reading of 2% hydrogen, yielding a false positive reading. Even more problematic is that hydrogen was significantly underreported at static conditions and lower flow rates. A sensor calibrated under these standard conditions would fail to report a hydrogen leak if used under these lower flow or static conditions. Similarly, the NTM beta-prototype sensor design displayed a strong dependence on flow rate but approached saturation at a slightly lower signal level, without exceeding its output calibration range.

NexTech has implemented design solutions to mitigate the flow sensitivity of its hydrogen sensor. Through modifications to the sensor packaging and controls, flow sensitivity at elevated flows has been virtually eliminated, while sensitivity at static and low flows has been dramatically reduced (Figure 1). The reported hydrogen concentration corresponding to these sensor signals is shown in Figure 2 as a function of linear flow rate; the actual hydrogen concentration was held constant at 1% in air throughout this testing. As these data show, the modified sensor shows only a slight dependence on flow rate at very low flows (≤ 0.125 cm/s) and then stabilizes to a constant output over a wide range of elevated flow rates.

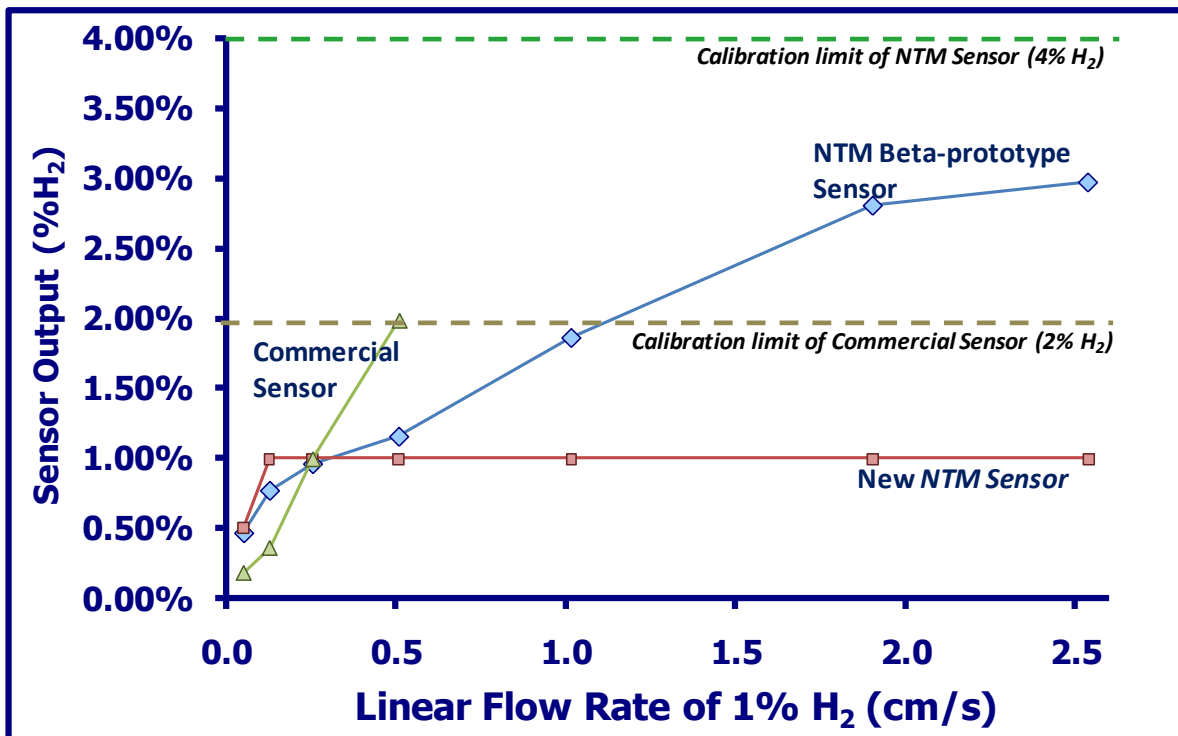


Figure 2. Flow insensitivity achieved at elevated flow rates through design improvements

Applying these response characteristics, NexTech has developed two sensor products. A sensor designed specifically for use under static conditions provides accurate hydrogen detection without the risk of underreporting dangerous hydrogen levels currently found in competitive sensors. A sensor designed for use under flow conditions provides an accurate and stable measure of hydrogen over a wide range of flow conditions – capability not currently offered in competitive sensor devices.

The NexTech Hydrogen Sensor SenseH₂[™] is offered by NexTech’s NTM Sensors division. For more information, please visit our website at www.NTMSensors.com.