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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. Other 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 a 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 competitor's 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.

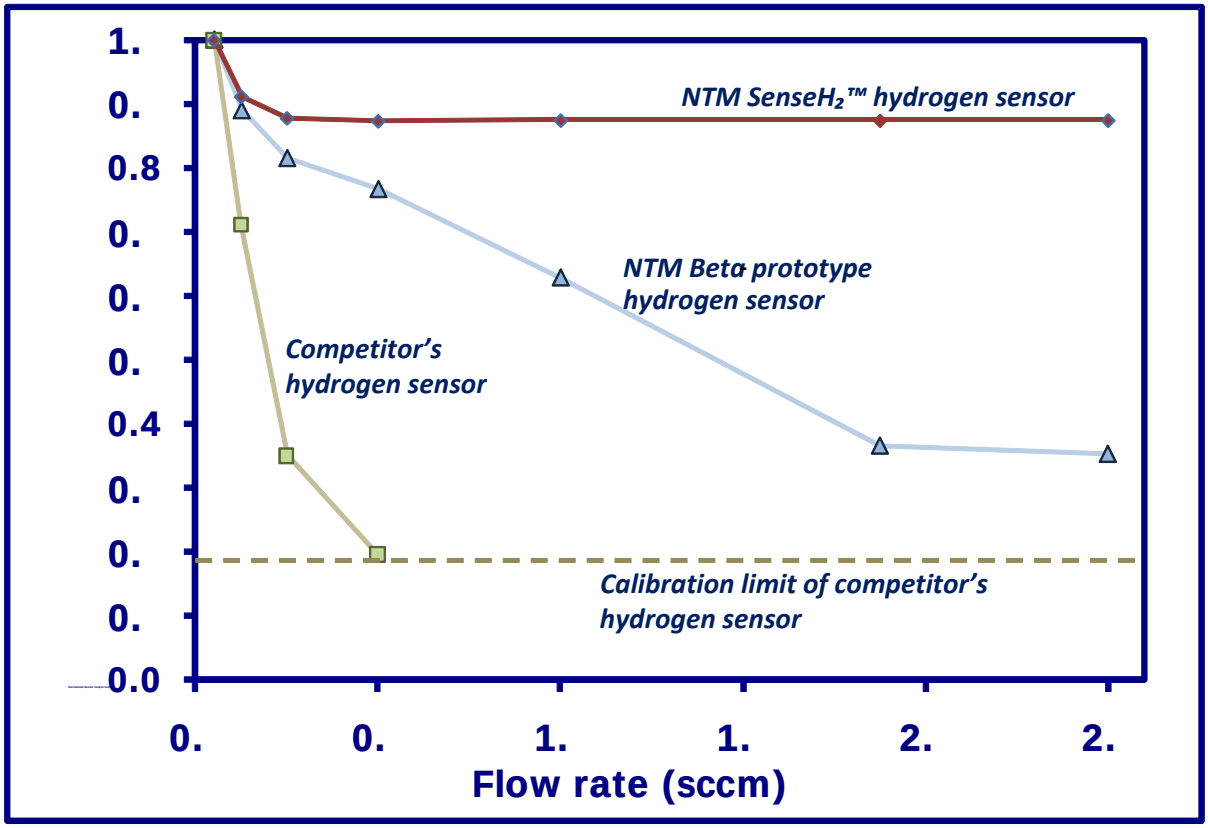

Figure 1. Flow sensitivity of the NTM beta-prototype sensor and competitor's *hydrogen sensors.* Competitor's hydrogen sensors bottom out at its calibration limit at relatively low flow rates (0.5 cm/s).

In this testing, the competitors' sensors 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.

NexTech implemented design solutions so that 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.

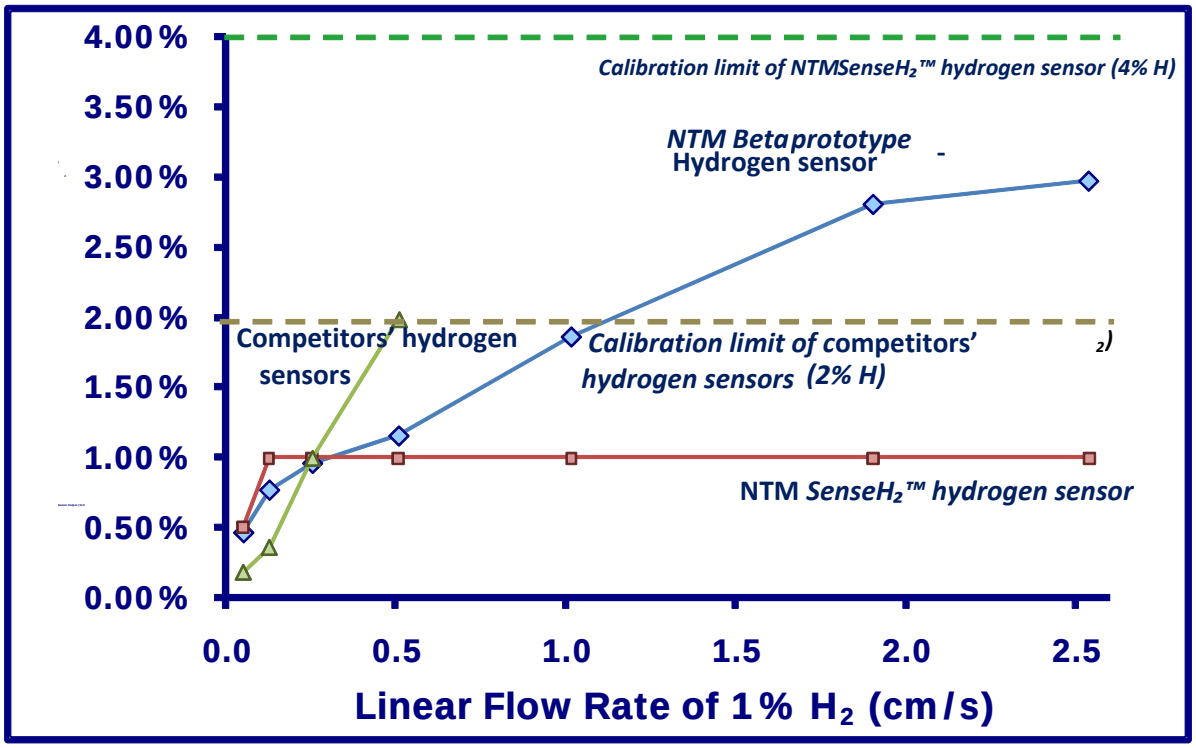

Figure 2. Flow insensitivity achieved at elevated flow rates through design improvements

Applying these response characteristics, NexTech has developed the required two flow sensitivity needs into one product in our NTM SenseH₂™ hydrogen sensor. The NTM SenseH₂™ incorporates a hydrogen sensing solution designed for use under static conditions which provides accurate hydrogen detection without the risk of underreporting dangerous hydrogen levels that is currently found in competitive sensors. In addition the NTM SenseH₂™ hydrogen sensor has the ability to sense hydrogen in conditions with a variety of flow rates with an accurate and stable measurement of hydrogen over a wide range of flow conditions.

The NexTech NTM SenseH₂™ hydrogen sensor is offered by NexTech's NTM Sensors division. For more information, please visit our website at www.NTMSensors.com.