SENGENUITY
sensor engine technology
a division of Vectron International

Calibration of the SenGenuity ViSmart Viscosity Sensor

A batch of 18 ViSmart™ sensors were calibrated from -30°C to +145°C using a series of six standards from Cannon Instrument Company.

The sensor calibration was completed and the calibration files were created without data windowing or "transition smoothing". That is, if data existed for a standard at that temperature, it was employed. Furthermore, the inherent discontinuity between temperatures with N and N+1 standards having valid data was not smoothed over. These additional windowing and smoothing algorithms are being developed for the ViSmart™ within the next 6-12 months.

The calibrated sensors were evaluated (see Figure 1) in N350 oil standard (a standard having 350 cS viscosity at 40°C). The oil is known to exhibit clouding below 20°C. The black dashed line represents the ideal acoustic viscosity (acoustic viscosity = cP X density) of the calibration standard. While the sensor is capable of measuring material well in excess of 10,000 AV, the particular oil exhibits clouding and phase separation at low temperatures. One property of acoustic sensors is that lighter fractions will act as lubricants between the surface and the solid content when the solution clouds (becomes heterogeneous). Another is that semi-solids do not exhibit acoustic damping (they become elastic solids upon clouding) and are not perceived as "viscous", despite their high resistance to flow upon waxing.

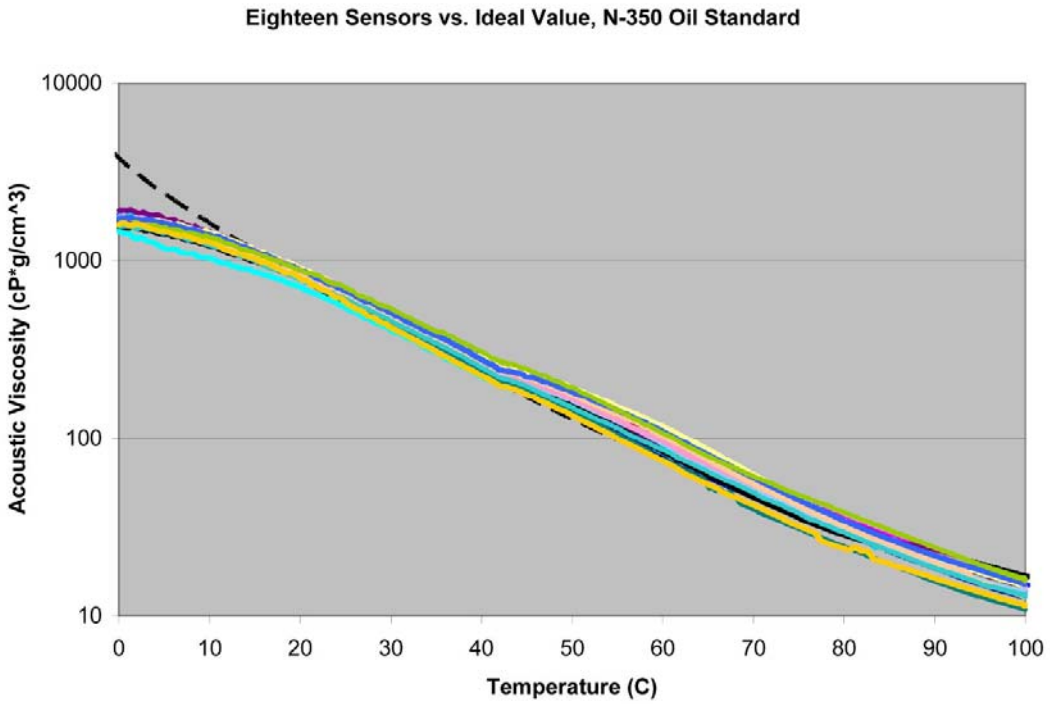

Figure 1: Measurement of 18 calibrated sensors in N350 calibration standard.

Sodium hydroxide had no negative effect (see Figure 1) until after prolonged heating at 60-90°C, and only then after becoming a gel. The alkali attacked both the 304 stainless steel and the epoxy seals, completely denaturing the epoxy.

Phosphoric acid (see Figure 2) had no immediately observable effect; however it appears to have embrittled the epoxy such that thermal shock led to detachment of the epoxy from the crystal sensor and subsequent leakage. The sensor was replaced and the new sensor functioned consistently; however the acid was notably colored by material leached from the epoxy. Furthermore, the second acid-test sensor failed within two days in a subsequent test in a proprietary polyurethane resin (different from the resin in the present test).

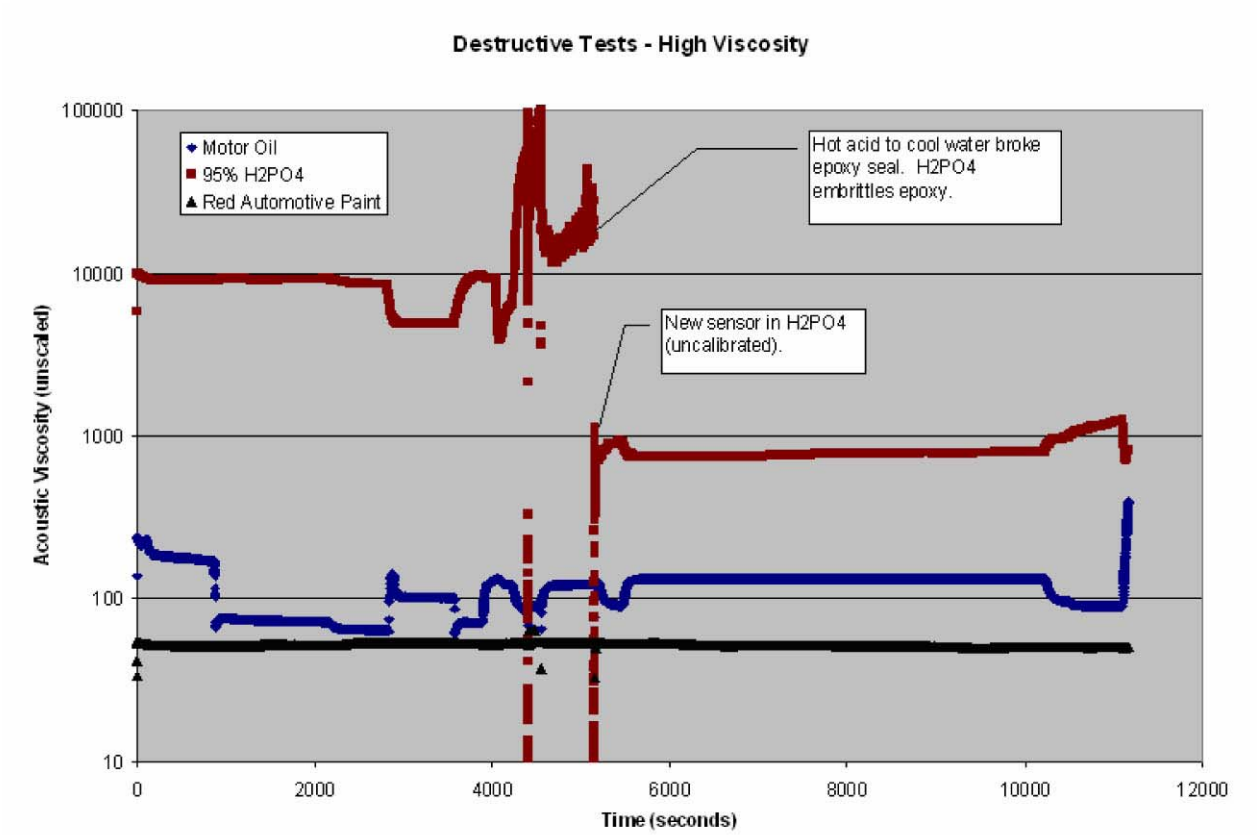

Figure 2: Three sensors in relatively "high" viscosity samples. Only phosphoric acid damaged the sensor and then only at elevated temperatures.

It is clearly evident the SenGenuity ViSmart™ sensor is extremely resistant to solvents and mineral oil as well as to aqueous solutions.

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