Set it and forget it oil condition monitoring. Sounds pretty good, doesn't it?

Vectron's ViSmart

Technological advances have made in-line fluid monitoring more feasible and cost effective than ever before. Vectron's ViSmart is a line of new breed acoustic wave sensors that can give you real time information on viscosity and temperature which are key parameters in determining your lubricating fluid's health. Karem Durdag, Vectron's Director of Business Development took some time to answer our questions about acoustic wave technology, the ViSmart sensors and in-line fluid monitoring in general. Here are his thoughts on the technology and where it will lead...

Vectron's ViSmart Sensor

First, why don't you briefly explain in layman's terms how acoustic wave sensing in general works?

The semiconductor chip is excited using transducers that are etched on the chip itself and vibrated at a very high frequency (160 MHz or 5 MHz). When it vibrates, it generates a sound wave through the thickness of the chip and across the surface of the material from the input transducer to the output transducer. Because of the vibration, the molecules of the fluid (oil) move and when they move, they absorb the sound wave energy. The difference in the input and output values is directly related to the viscosity-density product. The viscosity is measured instantly as soon as the fluid touches the sensor surface. It's important to keep in mind five things that Vectron has done to advance the technology so that we offer a reliable, robust commercial product:

1. The transducers are on the opposite side of the sensor surface, so all the electronics are completely and hermetically sealed from the sensor surface side. This enables the entire surface to be completely immersible.
2. There is a proprietary hard coat on the sensor surface itself which is scratch proof, abrasion resistant and chemically inert. This results in the sensor surviving in very harsh and particulate laden environments.
3. The temperature range is large (-25° C to 125° C), the viscosity range is wide (1 to 10,000 cP depending on model) and the accuracy is high (1-5% depending on conditions and fluids).
4. Because there are no moving parts it is immune to flow (as long as the fluid touches the sensor surface it will measure viscosity) and vibration (has passed 100G applications).
5. By taking advantage of standard semiconductor packaging and manufacturing practices it's cost-effective and embeddable for real-time, in-line applications.

Now why don't you tell us what ViSmart sensors bring to the table?

We know what maintenance professionals in the oil condition monitoring community need from a viscosity sensor. We focus on bringing trouble free, automatic viscosity measurement within reach for any facility. All of our sensors meet what we think are the fundamental requirements for a viscosity sensor:

1. The sensor has to be very robust, cost-effective and extremely easy to install.
2. It's operating range has to be wide enough to handle a multitude of oils and environments.
3. It has to be accurate enough to provide performance as a lab tool and repeatable enough to perform as all the other sensors we are used to working with (pressure, temperature and flow).

In additional to the fundamentals, what the ViSmart sensor accomplishes is to provide the customers with the following:

1. It is durable and reliable. It's been used in extremely challenging applications from down-hole drilling (extremely high temperature and pressure) to deep space (extreme high reliability).
2. It's scalable and cost-effective because it's made on a semiconductor fabrication line. This results in a solid-state viscometer that is commercially available to all customers.
3. Because it's small (our half inch threaded bolt version is only the size of a quarter), it can be installed in existing mechanical interfaces with all the communication protocols present.
4. The sensor can measure hydraulic, turbine, gearbox, engine and both synthetic and multi-grade oils and provide temperature data.
5. Of course, measuring relative changes from a baseline is something the sensor does everyday at our customer sites. We can also create correlation function on an oil-to-oil basis for 99% accuracy, if needed. Finally, because the sensor itself is made from semiconductor wafers, we can achieve % repeatability in the sensors.

You make high shear and low shear models of ViSmart. Please explain the difference, and what applications they are best suited for.

The high shear sensor operates at 160 MHz while the low shear sensor operates at 5 MHz. The differences are that the high shear has very wide operating range (3 to 10,000 cP) and measures the viscosity of extremely thick fluids (in the excess of 500 cP at room temp). During its operation, it will impart shear thinning to the oil. We can also work with the customer to determine if measuring relative viscosity changes or correlating to lab measurements is a desired solution. The accuracy levels on this sensor range from 5% to 10% depending on the application. The applications it is best suited for are:

a. Process fluids in the coatings industry (ranging from paints to inks to slurry to adhesives and specialty applications).
b. Very viscous oils such as those used in wind turbine gearboxes.

The low shear is specifically targeted to the oil condition customers that need to measure the viscosity of oil from 1 cP to 500 cP with accuracy levels of 1%, and there is significantly less shear thinning imparted to the oil. We can easily report the data correlated to the lab tools or use it for relative measurements. The applications it is best suited for are: mobile applications (on & off-highway vehicles, including marine), fixed asset (power generation, turbine, gearboxes), plant-wide asset (rotating equipment), hydraulics and petroleum.

Are there any conditions (types of liquids, harsh environments, etc.) where ViSmart sensors should not be used?

We recommend that the sensor not be used with hot (in excess of 60° C) concentrated sulfuric acid or sodium hydroxide. Also, given the performance and resolution range of sensors, we recommend not using the sensor for liquids that are 1 cP or less in viscosity.

Please explain the data collection process of the sensors and how they interface with the user's data system.

The signal generated is a voltage. Using converters and signal processing we can provide 4-20 mA outputs and other standard protocols (for example, we offer USB connectivity) for ready interface to any host control system. We are currently working on our next generation sensor that has CANBUS and DeviceNet capability.

In-line, real-time fluid monitoring seems like the most efficient method to gauge the health of your fluids. Why doesn't every company that uses fluids employ in-line fluid monitoring?

Well, for a long time the ideal solution was not available from a size, cost and reliability point of view. This has resulted companies continuing to use traditional methods. Given the new advances in technology and products, there is a learning cycle and a level of comfort that needs to be established. We are confident that as more people realize the availability of these kind of commercial products, more and more companies will utilize in-line fluid monitoring.

What are the three top reasons a company should consider investing in ViSmart sensors?

First - It provides a portable and embeddable instantaneous, real-time, in-line measurement of viscosity that is a key parameter in process control and oil condition monitoring.
Second - It delivers the tool to optimize costs and make objective real-time decisions, whether process or equipment related.
Third - It is flexible enough for customization, allowing our customers to differentiate themselves from their competitors.

What is time frame a company can expect for a return on their investment in ViSmart sensors?

It varies, but our on average customers report a return on investment on the order of 3 months or less. The key aspect in this determination is if the customer already has a strong database of cost information of capital equipment costs, day-to-day maintenance costs and scheduled down-time. The sensor enables cost optimization in all of those regards and can be readily assessed. For applications, where the sensor is used for process control, cost of elimination of waste and reduction in trouble-shooting is also factored in. And finally, for applications where the sensor is embedded, the cost return is measured in extension of the life cycle of the equipment asset, readiness of the asset for operation on a 24/7 basis and prevention of catastrophic failure.

Give us a success story or two from companies that are using ViSmart sensors now.

One great success story is an install in a marine diesel engine where the customer using the ViSmart sensor to monitor whether the right oil is being used or not, amount of fuel dilution (Fig 1) and if the viscosity of oil is within spec across the entire temperature range as it gets used (Fig 2). The sensor has been used 24/7 for 6 months in this challenging shipboard environment. The customer has been very satisfied with the results.

How can interested people get more information about ViSmart sensors?

Our community members can visit www.visensor.com to get all the information they need and call Dan McCormick at 603-578-4077 to ask for in-depth information.

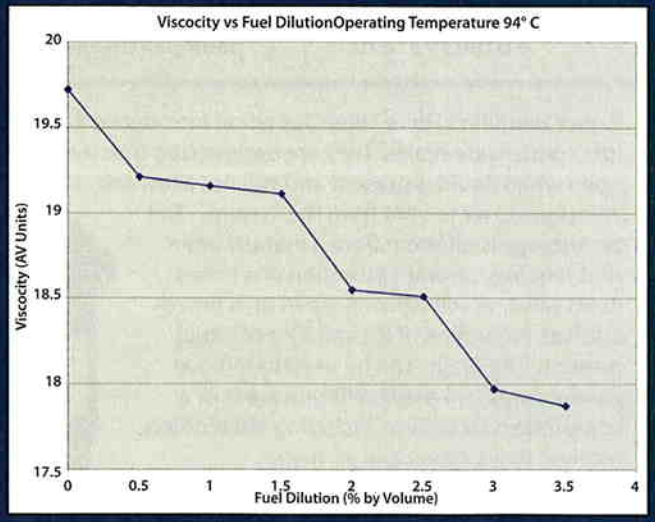

Fig1 - Viscosity change as a function of fuel dilution

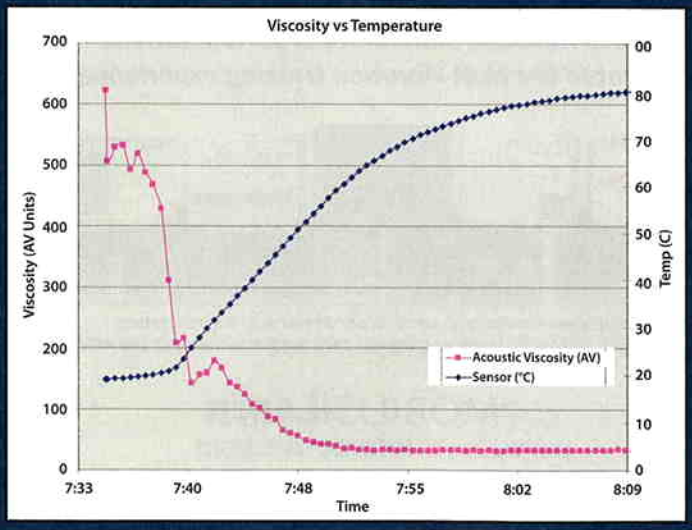

Fig 2 - Viscosity change vs Temperature