

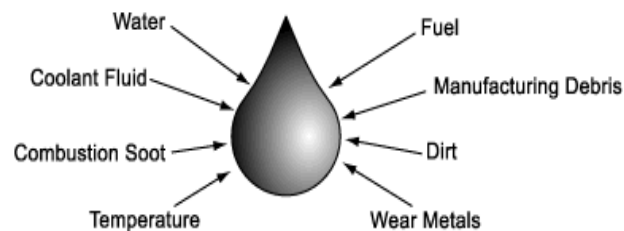


Integrated Oil-Quality Sensor

Opportunity Statement

The impact of oil degradation and contamination on lubrication equates to billions of dollars per year in lost productivity, maintenance and replacement costs. From power plants, to steel mills to aircraft engines, this issue spans the industries that drive our economy.

One example relates to the rapidly growing wind turbine industry. In addition to the baseline downtime resulting from calm winds, a typical wind turbine experiences an additional 20-25% in downtime due to gear train and trim problems. Other potential applications include remote pumping and storage facilities as well as chemical/petrochemical processing plants.



There is a need for a consistent, high-quality, real-time, cost-effective oil condition sensor that measures and reports chemical degradation, total contamination and water content in oil, as well as oil temperature, all simultaneously in a single unit.

Technology Landscape

Limitations of existing technologies:

- Do not measure all of the key parameters, cited above, in a single unit
- Sensor suites that measure all of the key parameters are very expensive (\$13K or more)
- Reliability is inconsistent
- Some sensors do not provide real-time data to the user

360ip Partner's Solution

360ip Partner's technology is the only available solution that meets all of the needs of the Opportunity Statement. It provides the following data in real time within a single, cost-effective sensor. The

Integrated Oil-Quality Sensor

Principle Investigator has been a leader in oil-quality analysis research and oil- monitoring sensor design since 1995.

Component	Characteristics
Chemical degradation and total contamination sensor	<ul style="list-style-type: none"> ❖ Measures and monitors chemical degradation and total contamination ❖ Uses light-emitting means (LED) and color-sensing methods to measure optical intensity in red, green and blue wavelength ranges passing through oil
Water sensor	<ul style="list-style-type: none"> ❖ Measures and monitors water saturation relative to oil ❖ Temperature compensation function is applied
Temperature sensor	<ul style="list-style-type: none"> ❖ Measures and monitors oil temperature ❖ Output voltage directly proportional to oil temperature
Electronic module Electronic module (continued)	<ul style="list-style-type: none"> ❖ Monitors chemical degradation, total contamination, water saturation and temperature while informing user of present status of oil in real time ❖ Compares four parameters and determines limit value while informing user of optimal exchange time of oil ❖ Informs user of operational status of machine using oil

The integrated oil-quality sensor utilizes the optical absorption of polychromatic light in a 2cm-thick oil column to measure four parameters of lubricating oils; hence, providing real-time data for machine condition monitoring. Changes in polychromatic light transmission in the oil due to degradation are translated into oil condition-indicative parameters by the device. It concisely detects oil-chemical degradation by thermal and oxidative degradation, oil total contamination by wear particles and physical dust (dirt) ingress, as well as oil- water content and temperature in one, integrated device.

Integrated Oil-Quality Sensor



Integrated Oil-Quality Sensor Prototype

The sensor is a reliable and cost-effective device to maximize oil useful life, filter life and equipment reliability, thereby minimizing maintenance costs and machinery downtime. Likewise, the environmental impacts of used oil and filter disposal are also minimized. The sensor is a fraction of the cost of sensor suites that measure the same parameters.

It is particularly effective for hydraulic and turbine oils. The sensor can be applied in off-line laboratory settings for oil analysis as well as for in-line/on-line applications when bolt-mounted on oil tanks or hydraulic lines. The sensor's simple and compact design provides the user with the ability to mount it on almost any machine.

The sensor has been extensively tested and is being successfully piloted at a major steel production facility. Test results are available to interested parties. Likewise, a production sensor prototype is available for inspection and testing. The technology is covered by four issued United States Patents together with corresponding patents in selected countries.

360ip is seeking interested parties for the licensing, further development and commercialization of this technology-based solution.

For additional information, contact licensing@360ip.com

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