



Press information from Sensor Instruments

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The measurement of thin oil layers with MIR – a highly interesting matter.

25/11/2020. Sensor Instruments GmbH: The tension is rising! The users of cleaning units for metal parts – e.g. stamped parts – wait with baited breath to see what the washing sequence brings forth. Has the surface tension exceeded the threshold of 38 mN/m or has it even climbed to 44 mN/m? A metal component is generally taken to have been de-greased if one of these values (which of the two, depends on the intended application) has been exceeded. Previously, test ink was used to demonstrate the surface tension. These liquids are available in various surface tension values, usually starting with 30mN/m to 50mN/m in steps of 2mN/m (30mN/m, 32mN/m, ..., 48mN/m, 50mN/m). If the test ink does not roll off the metal surface after application, the surface tension of the metal part lies above the value specified for the test ink. On the other hand, if the test ink does roll off the metal surface, the surface tension of the metal lies below the value specified for the test ink. In this way, the surface tension can be ascertained with an accuracy of 2mN/m.

What does the surface tension mean in relation to the property of the respective metal surface? De-greased metal surfaces present a surface tension above 50mN/m (ascertained with the test ink method). On the other hand, if a metal surface is covered with an oil film, (for example, through oiling the punching strip before punching), the value of the surface tension can fall under 30mN/m, depending on the thickness of the film. The test ink method is therefore capable of determining whether the metal surface is covered with an oil film, or whether it has been removed (de-greased). Even oil films of less than 1µm can be demonstrated with this method.

Is this method suitable for production? Not for 100% checks: Not only does the ink test method take a considerable amount of time to perform, it is also not non-destructive, leaving behind as it does, certain traces on the component investigated in this way.

As the ink test method has proven a success, at least in random checks, and has established itself in industrial practice, we at Sensor Instruments have developed a measurement procedure that ascertains the surface tension of a certain metal surface. This new method requires the establishment of the relationship between oil, the surface of the metal and the test ink before the actual measuring procedure (i.e. calibration) before measurement of the INLINE. Although this establishes an exact reference to the test ink method, measurement is performed using a completely different method.

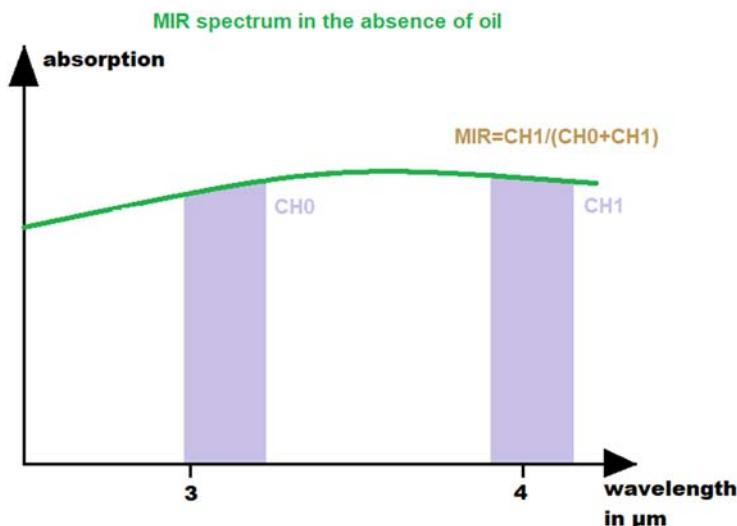
Experiments with various oils have shown that almost all oils have a selective absorption rate in the mid-wavelength infrared light range (MIR). Using this characteristic means that the comparison of two MIR wavelength ranges (one range is the neutral range, i.e. the wavelength range in which no noticeable absorption occurs as a result of the oil) can be used to determine the thickness of the oil layer after calibration of the **SPECTRO-M-10-MIR/(MIR1+MIR2)** measurement system, and in a subsequent step, to display the respective surface tension value.



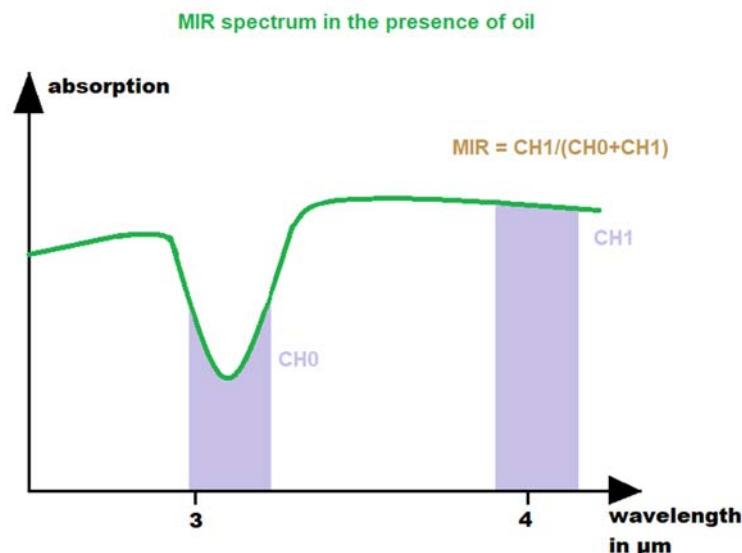
Surface control of punched parts for the presence of an oil film, measured with the **SPECTRO-M-10-MIR/(MIR1+MIR2)**.



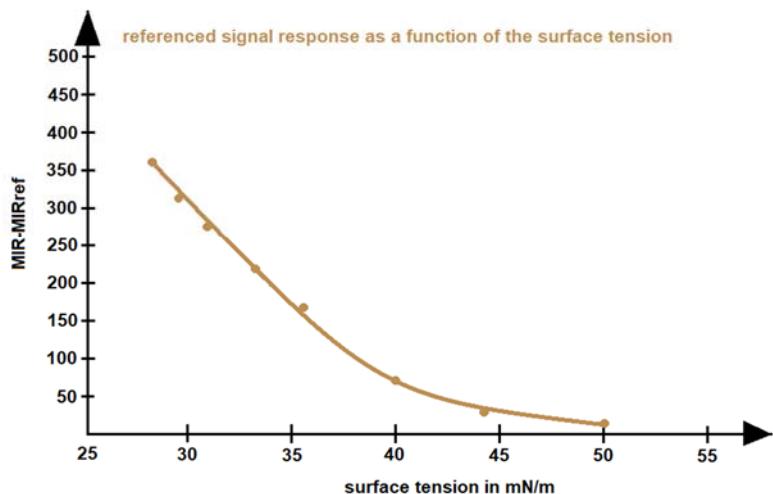
The test ink method: The rolling off of the test ink indicates that the surface tension of the metal surface lies below the specified surface tension of the test ink used. Wetting the metal surface with the test ink indicates that the surface tension of the metal surface lies above the surface tension of the test ink.



Schematic depiction of the MIR spectrum of a de-greased metal surface. Approximately the same signal strength can be measured in both reception windows (CH0 and CH1).



Schematic depiction of the MIR spectrum of the metal surface with an oil film. A significantly higher absorption rate is registered in one of the two reception windows (CH0) in comparison to other entry windows (CH1), the reference window.



Typical relationship between the value measured with the **SPECTRO-M-10-MIR/(MIR1+MIR2)** and the surface tension measured with the test ink method.



The sensors of the **SPECTRO-M-10-MIR/(MIR1+MIR2)** is cased in a robust aluminum housing designed for use in demanding industrial conditions. In addition to the digital outputs (0V/+24V) and analog outputs (0V...+10V or 4mA...20mA) for connection to a PLC (0V/+24V) digital serial interfaces (USB, RS232, Ethernet) and soon also Profinet are available.

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