GREASE SENSOR FOR CONDITION MONITORING OF ROLLING BEARINGS

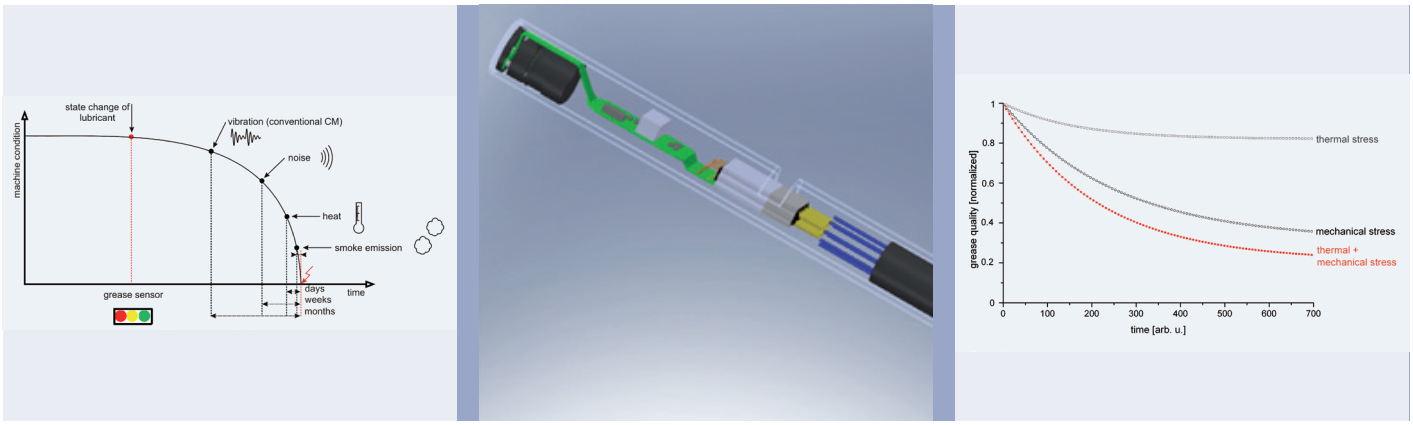

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Figure: Indications of rolling bearing failures at different times (left); Basic design and function of the grease sensor (center); Measured grease quality over time (right)

Photo acknowledgments: Fraunhofer ENAS; The described system represents a successful development together with Schaeffler Group, Freudenberg and Kluber. It is not a commercial product of Fraunhofer ENAS.

Disadvantages of previous methods

Many bearing failures can be attributed to old grease. It is now possible by means of condition monitoring, such as analysis of vibrations, to detect defects in machines at an early stage. This, in turn, enables maintenance measures to be precisely scheduled, thereby preventing secondary damage to bearings and transmission components. The disadvantage of this method is that damage must already be present in the machine in order for a signal to be detected. With the aid of the newly developed grease sensor and the associated electronic evaluation system, it is now possible to detect changes in the condition of the grease long before any damage to the rolling bearing occurs. This means that replacement of the grease can be precisely planned, whereby the user can decide at which point in the condition of the grease relubrication or a grease change should be carried out. With the new grease sensor, relubrication is changed from time-based to demand-based. The grease sensor is a common project of Schaeffler Technologies GmbH & Co. KG, Freudenberg Sealing Technologies GmbH & Co. KG and Klüber Lubrication München KG working in partnership with Fraunhofer ENAS.

Design and function of the grease sensor

It became clear that optical infrared reflection was the ideal method for determining the condition of the lubricant during ongoing operation of the rolling bearing. The sensor head is embedded in the lubricant. At the same time, a reference system exists that undergoes ageing in parallel is subjected to the same temperature but does not have any contact with the grease. The measured signal is compared with this reference system. The penetration depth of the signal extends from the surface of the sapphire glass on which the lubricant is located to a few millimetres into the lubricant. The optimum measurement point varies from application to application. In this connection, it is advisable to draw on the know-how of the Schaeffler Group application engineers, who can specify precisely where the sensor should be positioned in the specific application. During the validation phase, precise analysis was carried out to determine the influence of individual contaminants in greases on the signal. The sensor can be used to determine four parameters relating to the lubricant opacity, wear (mechanical, thermal), water content and temperature.

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