The New Application of Metal Oxide Gas Sensors in Fluid Power Systems

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Abstract:

In fluid power systems, the fluid (generally mineral oil with many additives, therefore a dangerous agent for the environment) carries out lubrication and power transmission acting as essential extended component. Hydraulic fluid, characterized by many chemical-physical properties, is subjected to an unavoidable degradation that causes a drop in machine efficiency and reliability up to system breakdown with leakage of pollutant material and generally expensive unplanned machine stop. On the other hand, the fluid state can be exploited as an indicator of the state of health of the system in order to perform the predictive maintenance, increasing the energetic efficiency, the reliability and the sustainability of the system. The present work aims to develop a new online device based on nanostructured MOX gas sensors to perform the fluid state monitoring through the analysis of its vapors. For this purpose, firstly the correlation between the fluid state and its vapor composition monitored with an array of MOX sensors (based on traditional and advanced materials) has been studied and established in the case of a traditional mineral oil [1]. The thick film technology, used to prepare the MOX sensors, ensuring low cost, small size, easy use and versatility of the final online sensor device [2]. For this work a broad investigation has been performed with the aim of validating the methodology by i) studying other kinds of hydraulic fluids (mineral and synthetic), ii) doing additional characterizations of the oil aged samples and iii) testing new sensors based on different nanostructured semiconductor oxides.

[1] Fioravanti, A.; Marani, P.; Massarotti, G.P.; Lettieri, S.; Morandi, S.; Carotta, M.C. (Ti,Sn) Solid Solution Based Gas Sensors for New Monitoring of Hydraulic Oil Degradation. Materials 2021, 14, 605.

[2] Fioravanti, A.; Bonanno, A.; Gherardi, S.; Carotta, M.C.; Skouloudis, A.N. A portable air-quality station based on thick film gas sensors for real time detection of traces of atmospheric pollutants. IOP Conf. Ser. Mater. Sci. Eng. 2016, 2016 108, 012005.

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