Reliability Improvements for an Automotive Fuel Level Sensor

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An experimental program was undertaken to improve the rotational life of an automotive fuel level sensor. The potentiometric design of this sensor utilizes a Pd based contact material sliding along two thick film, conductive Ag tracks. One track was the continuous ground or return leg, and the other track was composed of discrete segments radially terminated into the resistive leg. Abrasive wear of the contact sliding against the segmented track was found to determine the useful lifetime of the sensor. Previous work had shown that reductions in the contact normal force produced unacceptable noise due to a failure to break through the gasoline generated sulfide films on the inks. This paper reviews the efforts to improve the wear characteristics of the inks. Although some wear improvements were obtained by mechanical polishing after firing, this introduced output noise caused by sulfide films. More dramatic improvements were achieved by utilizing a different ink formulation that incorporated a finer frit. With the new ink and an optimized firing schedule, it was possible to achieve a smooth surface without the need for a post fire polish. The new ink produced a useable lifetime of over 4 million full cycle rotations compared to roughly 600,000 cycles with the older, rougher ink