DEVELOPMENT OF ENGINE OIL QUALITY ANALYZER BASED ON OPTICAL METROLOGICAL TECHNIQUES

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With an annual global consumption of 36.3 million tons of engine oil and concerns about premature disposal, we propose an optical metrological approach to accurately assess engine oil quality. A side polished optical fiber in touch with oil, photo diode and a photo detector were used to build the sensor unit. To avoid damage to the core, cladding removal was performed meticulously, while minimizing wire bending reduced optical power loss. Utilizing a side-polished optical fiber, the refractive index changes in engine oil were measured, allowing real-time assessment. This method offers non-destructive, precise, and straightforward measurements. Theoretical validation was done by utilizing Fresnel's equations. Further a correlation between theoretical values and refractive indices of oils with mileage was established. For the oil type 10W-30, which is used as the engine oil for petrol engines, a change of refractive index of 1.4651 to 1.4689 was observed over a milage of 3140 km. the detector voltage ratio for that range was 0.5928 to 0.6748, which is well within the range the sensor can detect. Similarly, an experiment conducted for oil type 15W-40, which is an engine oil used in diesel engine showed a refractive index variation of 1.5966 to1.6015 over a milage of 3721 km, which corresponds to a change of sensor voltage ratio 0.5427 to 0.4571 was obtained. Both experimental data and theoretical predictions confirmed that the sensor is effective and sensitive to subtle change in oil quality. This research successfully developed optical metrology, offering potential for online oil quality monitors, and addressing environmental concerns linked to premature oil disposal.

Keywords: Fiber Optic, Optical Loss, Total Internal Reflection. Engine Oil Quality