Fuel level sensor based on polymer optical fiber Bragg gratings for aircraft applications - DTU Orbit (24/08/2019)

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Safety in civil aviation is increasingly important due to the increase in flight routes and their more challenging nature. Like other important systems in aircraft, fuel level monitoring is always a technical challenge. The most frequently used level sensors in aircraft fuel systems are based on capacitive, ultrasonic and electric techniques, however they suffer from intrinsic safety concerns in explosive environments combined with issues relating to reliability and maintainability. In the last few years, optical fiber liquid level sensors (OFLLSs) have been reported to be safe and reliable and present many advantages for aircraft fuel measurement. Different OFLLSs have been developed, such as the pressure type, float type, optical radar type, TIR type and side-leaking type. Amongst these, many types of OFLLSs based on fiber gratings have been demonstrated. However, these sensors have not been commercialized because they exhibit some drawbacks: low sensitivity, limited range, long-term instability, or limited resolution. In addition, any sensors that involve direct interaction of the optical field with the fuel (either by launching light into the fuel tank or via the evanescent field of a fiber-guided mode) must be able to cope with the potential build up of contamination – often bacterial – on the optical surface. In this paper, a fuel level sensor based on microstructured polymer optical fiber Bragg gratings (mPOFBGs), including poly (methyl methacrylate) (PMMA) and TOPAS fibers, embedded in diaphragms is investigated in detail. The mPOFBGs are embedded in two different types of diaphragms and their performance is investigated with aviation fuel for the first time, in contrast to our previous works, where water was used. Our new system exhibits a high performance when compared with other previously published in the literature, making it a potentially useful tool for aircraft fuel monitoring.

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