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Development of FBG-based Sensor Manufactured by FDM Technology to Monitor Pressure Changes

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Abstract—The 3D printing technology uses a variety of methods in its molding, prototyping, and manufacturing applications, but Fused Deposition Modeling (FDM) is famous for its customized use. In this study, the pressure sensor was manufactured by embedding the fiber grating sensor into the Fiber Bragg Grating (FBG) through the FDM process, and the raw material of Polylactic Acid (PLA) was used in the fabrication method of the pressure sensor. The pressure test was carried out using this new FBG sensor by loading and unloading tests. The measurement results showed that the maximum load imposed on the pressure sensor was divided into a measurement pressure range of ±58-352 Newton's and the sensitivity to the measure of the two FBG sensors was about 0.00053 nm/N and 0.0012 nm/N, respectively. It was found that the maximum error of the FBG sensor was13.3% when performing a vertical load of 0.35 KN. The FDM process was a new alternative to its fast and direct FBG sensor manufacturing and embedding method, which can be used in many applications. Also began to use molten PLA raw materials to fully protect the FBG sensor without losing its sensing performance and damage.

Keywords—Fused Deposition Modeling, Fiber Bragg Grating, Polylactic Acid, Pressure Measurements