

## **Measurement of temperature change on coil column unit using FBG sensors during thermal response test: A study for geothermal energy system**

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### **ABSTRACT**

The accurate measurement of temperature in the ground source heat pump system is crucial for assessing the thermal response of the system and validating the numerical model for parametric study, which is necessary for the thermal performance evaluation of the geothermal energy system. Conventional temperature sensors have some disadvantages such as they are difficult to install, and their position can be shifted during the backfill process of the ground heat exchanger. In this study, Fiber Bragg Grating (FBG) sensors were used to measure the temperature change of a recently developed ground heat exchanger (Coil Column Unit, CCU). FBG sensors were first calibrated in a thermal chamber alongside a correlation sensor (RTD sensor). The calibrated sensors were then mounted on the pipe surface at each spiral of the CCU to measure how temperature changes during the in-door mockup thermal response test. Finally, the measurement results of the FBG sensors were verified with a finite element coded program. The results indicated that the temperature difference between the numerical analysis and the experiment was less than 1%, which is significantly lower than that of the previous study using the RTD sensors. Therefore, it is feasible to apply FBG sensors for temperature measurement during the operation of the TRT of the geothermal energy system.

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