

## Downhole temperature measurement with FBG system

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In fy2003, a drilling campaign of Tokaioki -Kumanonada in the eastern Nankai Trough area was achieved. In this program, two sets of a high-precise temperature measurement system using DTS (Distributed Temperature Sensing) and FBG (Fiber Bragg Grating) systems were developed and installed in two wells respectively; one in Tokaioki and the other in Daini-Atsumi. The goal of this project was to acquire the world-first detailed downhole temperature profile through marine hydrate in order to investigate the relation between the natural hydrate stability and temperature/temperature gradient, and the temperature behavior in regards to seasonal and tidal changes.

Both the DTS and FBG systems utilize the optical fibers as the temperature sensor. The sensor cable was installed and clamped outside and along the tubing. All the measurement system was installed inside the pressure-tight housing sitting on the seafloor. In addition, the measurement PC, equipments controller system and required batteries to operate the system were equipped in the housing. The measurement was done remotely according to the pre-programmed schedule for approximately 50 days during the measurement period. The programmed schedule was modified by confirming acquired data through acoustic communication between sea surface and the measurement system.

The DTS measurement aimed to acquire the entire well temperature profile at around 5 m interval with 0.1 degC resolution, and the FBG measurement system targeted more precise temperature estimation at some depths where the gratings were located on the fiber. From the data acquired in Tokaioki, overall downhole temperature was obtained by DTS system. In case of FBG measurement, though it was expected to have higher precisions in the temperature data than the DTS measurement, its absolute value was affected by other factors such as strain effect onto the fiber by physical changes of the well conditions. Instead, the relative change in time showed more detailed variation compared to DTS data, and indicated a relation between the tidal changes observed from independent measurement. In this study we will discuss mainly for the results from the FBG measurement system.

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