

Surveying of the cementation process in wells using fibre optic temperature measurements

Bücker, C.* , Großwig, S.** , Hurtig, E.** , Kitscha, R.* , Lundershausen, S. ***
*RWE Dea AG, **GESO GmbH, *** Inst. f. Bergbaukunde III, RWTH Aachen

1. Motivation

The cementation of wells has to provide a tight connection between the casing string and the drilled formation. Usually, acoustic (Cement Bond Log) or ultrasonic (USIT, CET, PET) techniques are used for inspecting the cementation. Information on the depth of the cement head can be achieved from conventional temperature measurements.

The fibre optic temperature sensing technique opens new possibilities to survey temperature during and immediately after the cementation of a casing string in a well. The temperature distribution is obtained with a high depth and time resolution simultaneously along the total length of the borehole including the cemented section. There are different objectives for applying this technique. At first the cement head should be determined accurately as rapidly as possible to reduce the service time of the rig. For this purpose, the fibre optic temperature sensing cable is installed temporarily inside the casing string immediately after completion of the cementation. Additionally, detailed information can be obtained on the cement setting process along the cemented borehole section.

Another objective is the permanent installation of a long-term monitoring system for monitoring well conditions during the well life. In oil and gas wells temperature effects caused by changing inflow rates of oil, gas or water can be determined immediately. This is helpful especially if there are several productive formations. In geothermal wells temperature measurements allow to detect temperature dependent characteristics of the formation (e.g. water movements along joints and fissures) which can be used to detect zones of heat losses or gains. During production the transfer of heat from the outside formation into the well and vice versa can be observed and the development of the isotherms along the well during production can be surveyed, which is of special interest for deep heat exchangers.

For these purposes the fibre optic system can be installed attached to the producing string or it can be installed attached to the casing in the annulus between the casing and the drilled formations or an already cemented outer casing. In the both latter cases the sensing cable is cemented when the casing is cemented and the temperature distribution can be measured during the cementation process and the operational life time of the well.

As examples, results are shown from a hydrocarbon well in the North-German Basin and the geothermal well RWTH - Aachen.