Perforation of Cementing with Gas-Coated Abrasive Waterjets

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Abstract

An additional perforation for cementing around casing has been required to cement an annulus between cementing and formation when a well is abandoned to prevent leak of natural gas. Perforation systems with submerged abrasive waterjets and with gas-coated submerged abrasive waterjets for steel casing have been developed. Goto (2007) applied the former system to fractured cementing under high ambient pressures of up to 2 MPa, and clarified the effects of both impinging time and the ambient pressure on depth of hole in the fractured cementing. Fukuzawa (2006) clarified the perforation performance of the later system to the steel casing.

In this study, to clarify the perforation performance of the submerged abrasive waterjets for the intact cementing, we conducted a laboratory test with submerged abrasive waterjets. Furthermore, to clarify the effects of both gas pressure and gas flow rate on the perforation performance to the intact cementing, we also conducted the laboratory perforation test with gas-coated submerged abrasive waterjets. Main results obtained in this study are summarized as follows: (1) Perforation performance of submerged abrasive waterjets for the intact cementing can be obtained by using a large size specimen of diameter of 150 mm and length of 150 mm with appropriate constraining specimen to prevent deformation. (2) The hole in the intact cementing is smaller than that in the fractured cementing, however the hole area of the inner side of the casing in the intact cementing is lager than that in the fractured cementing. This means that an effect of a back flow in the hole decreases in the fractured cementing, since a large fraction of inflow flows out through the fractures. (3) As both gas pressure and gas flow rate decrease, depth of hole in the intact cementing increases. This means that the gas nozzle developed in this study is not suitable for gas-coated, and accordingly more improvements are required to improve the perforation performance with gas-coated abrasive waterjets.