

# Perforation of cementing with abrasive waterjets under high ambient pressure

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## Abstract

An additional perforation cementing around casing has been required to cement annulus between cementing and formation when a well is abandoned to prevent leak of natural gas. A perforation system with abrasive waterjets for steel casing has been already developed. However, it has not been clarified whether the system can perforate cementing. In this study, to clarify the effects of both impinging time and ambient pressure on the depth of hole, laboratory perforation tests were conducted under high ambient pressures of up to 2 MPa for cementing around a polyvinyl chloride (PVC) casing. Main results obtained in this study are summarized as follows: (1) The depth of hole increases with the impinging time, while the increases rate of the depth of hole decreases with the impinging time. This indicates that the eroding ability of the abrasive waterjets impinged on the cementing decreases with the depth of hole. (2) The depth of hole decreases with the ambient pressure. This is because the amount of the cavitation clouds induced by waterjets decreases as the ambient pressure increases, and as a result the attenuation of the abrasive waterjets increases with the ambient pressure. (3) An empirical formula for the depth of hole as a function of the impinging time and the ambient pressure has been obtained. This formula predicts that, for example, the system perforates 77.5 mm in depth in cementing with PVC casing with a thickness of 9.95 mm under an ambient pressure of 1.0 MPa, and this provides useful values in an application to fields.