Experimental Evaluation Of Wellbore Cement- Formation Shear Bond Strength In Presence Of Drilling Fluid Contamination

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The objective of this experimental study is to investigate the impact of physical and chemical mud contaminations on cement-formation shear bond strength for sandstone and shale formations. Physical contamination occurs when drilling fluids (mud) dehydrates on the surface of the formation, while chemical contamination occurs when the drilling fluid reacts chemically with the cement slurry during a cementing job. We investigated the impact of the contamination on the shear bond strength and the changes in the mineralogy of the cement at the cement-formation interface to quantify the impact of the contamination.Wellbore cement has been used to provide well integrity through zonal isolation in oil & gas wells as well as geothermal wells. Cement failures could result from poor cementing, failure to completely displace the drilling fluids to failure on the path of the casing. A failed cement job could result in creation of cracks and micro annulus through which produced fluids could migrate to the surface leading to sustained casing pressure, contamination of fresh water aquifer and blow out in some cases. For this experimental study, Berea sandstone and clay rich rock discs/cores had cement bonded with them to simulate cement-formation interfaces. Shear bond tests were performed on the composite cores after complete hydration of cement to determine the shear bond strength. Preliminary results suggested that the detrimental impact of the contamination is higher when the cores are physically contaminated. Also, the results showed that shear bond strength is higher for sandstone formations when compared to shale formations, implying that the low permeability formations form much weaker bond with cement. Material characterization analysis was carried out to determine the micro structural changes at the interface. Electron microscopy provided coupling of chemical/mineralogical composition with geomechanics of the interface.