Departmental Seminar

Department of Civil Engineering and Engineering Mechanics
Columbia University

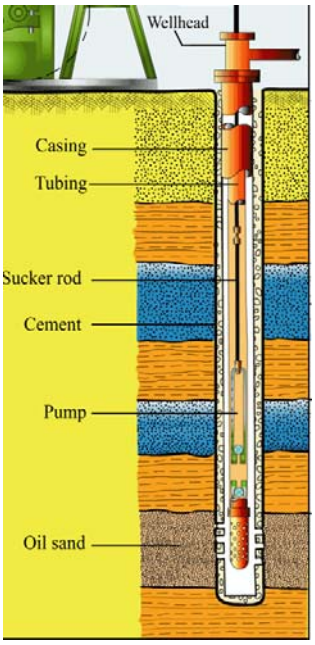
In-situ testing of oil well cements

Tuesday, November 30th @ 2:30pm

644 MUDD

Mr. Xueyu Pang, Doctoral Student, CEEM

One of the most important procedures during oil or gas well construction is the cementing job, which creates a sheath in the annulus between the steel casing and the wellbore, to restrict fluid migration between formations and to bond and support the steel casing. As both temperature and pressure increase with the depth of the wellbore, oil well cements are subject to wide ranges of temperature and pressure. It is quite a challenge to study the effects of these extreme curing conditions on the behavior of oil well cements because traditional testing equipment does not allow reliable in situ determination of mechanical and other properties. Even though specially designed curing vessels are capable of simulating down-hole conditions, samples normally are returned to ambient conditions before being tested. As a result, the subsequently obtained test results are unreliable since it is impossible to assess the potential damages introduced by the pressure and temperature changes.



This presentation discusses an innovative apparatus developed for the true in-situ determination of oil well cement properties, including tensile strength and chemical shrinkage. Samples were cast in pressure cells whose temperature and pressure were controlled by heating tapes and syringe pumps, respectively. A nontraditional hydraulic fracture method was used to determine the in-situ tensile strength of the samples without exposing them to ambient conditions. Test results were compared with those obtained by traditional splitting tests. Chemical shrinkage test results were used to assess the effect of curing temperature and pressure on the hydration kinetics of oil well cements.