Brazilian and Ring Tests in Assessing Indirect Tensile Strength of Sandstone

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Abstract

Rock materials are much weaker in tension than in compression and therefore, characterization of tensile strength is an important issue in rock engineering. Uniaxial tensile test is, however, difficult to perform because of practical problems in gripping rock specimens, aligning the specimen and applying a tensile load directly parallel to the specimen axis. On the other hand, Brazilian test requires thin disc specimens that are easy to prepare and the test procedure involves diametral compression of a disc where specimen failure is caused by an induced tensile stress (or indirect tensile stress). In this test, the induced tensile stress remains almost uniform about the loaded diameter. Compression-induced extensional fracturing generated in this test is also representative of the in situ loading and failure of rocks. Although Brazilian test is widely used for evaluation of rock tensile strength, some researchers pointed out that not only tensile stresses are developed in the disc but also high shear stresses are produced close to the loading platens. To limit the shearing stresses developed in the diametrically compressed disc in a Brazilian test, the method of ring test was developed where a disc with a central hole is subjected to diametral compression. Nevertheless, ring test has not gained much attention in routine rock engineering environments. This paper presents a comparison between Brazilian and ring tests (Figure 1) in assessing indirect tensile strength of sandstone from Korba Coal Field, Chattishgarh.

Laboratory investigations and subsequent analysis of test results revealed that Brazilian tensile strength (BTS) and ring tensile strength (RTS) are linearly correlated where BTS is found to be of higher magnitude than RTS for majority of the specimens. However, ring tensile test produces more consistent test results than Brazilian test. It was also found that RTS gives a better indication of applied energy than BTS. Microstructural

studies depicted that RTS also provides a better impression of the microcracks originally present in the concerned rock than BTS. As RTS value is generally less than corresponding BTS value, it is also more advantageous than BTS in an engineering environment from safety point of view. It is concluded that the use of ring test to characterize indirect tensile strength of rock materials should be explored further considering different rock types from different areas with specific geology in order to ascertain applicability of the test in routine rock engineering environments.

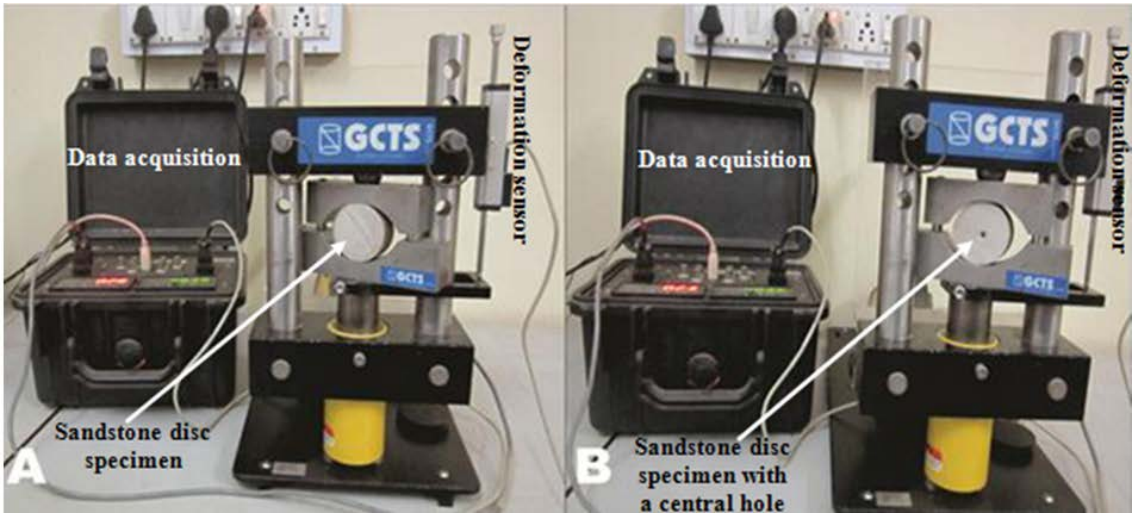

Figure 1. Laboratory setups for (A) Brazilian and (B) ring tests.