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Splitting tensile strength study of tin slag polymer concrete

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ABSTRACT

Tin Slag Polymer Concrete (TSPC) compressive strength has achieved 58.21 MPa which is an acceptable limit for structural application. However, there was insufficient information on the tensile strength of TSPC whereas tensile parameter is also important to provide an indicator of cracking failure estimation and numerical analysis application. Therefore, experimental study has been performed to examine splitting tensile strength of TSPC. Findings show that average splitting tensile strength for TSPC is 6.08 MPa which is about 10.44 % from TSPC compressive strength. The specimen also has shown brittle failure where fracture occurs with small deformation. The failure mechanism of TSPC share similar pattern with all specimen experience primary and secondary crack. Fractured surface of the specimen ST-1 shows smooth and flat while ST-3 shows rough, burst and scattered. In general the study on TSPC splitting tensile strength has found several findings includes average splitting tensile strength, average tensile modulus, TSPC brittle behavior, fractured surface as well as the primary and secondary crack formation during experimental test.

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1. Introduction

Splitting tensile strength is a parameter used to measure the tensile strength of a concrete material. Similarly, for a ductile material such as metals, the tensile strength is measured using uniaxial tensile test. However, as a brittle material, tensile strength of concrete is preferably measured by performing a splitting tensile test or Brazilian test. According to [7], tensile strength of concrete may be measured by uniaxial tensile test with special grips or by splitting tensile, but splitting tensile test is preferred as uniaxial tensile test is relatively complex. Splitting tensile test involve the application of compressive load on diametrical section of a cylindrical specimen to induce transverse tension until cracking failure occur and cause splitting of the specimen along vertical plane [4]. According to [5], tensile strength is equally important as compressive strength in a design of concrete structures. Compressive strength mainly measures the concrete material resistance to crushing failure, while tensile strength provides an indicator to estimate cracking failure of the concrete material. In addition to

that, according to ASTM C496, splitting tensile strength was applied in concrete structural design to evaluate shear resistance provided by concrete and thus reinforcement length can be determined. Other than conventional cement concrete, polymer concrete has also gain focus on researchers all around the globe. Recently, the study of polymer concrete with recycled material emerged especially with the application of industrial waste such as metal extraction slag as concrete aggregates. Tin Slag Polymer Concrete (TSPC) is a particle reinforced polymer matrix composite composes of crushed Tin Slag (TS) as fine aggregates and polymeric resins as matrix binder. TSPC is introduced after a study by [2] found that the strength of TSPC has achieved 58.21 MPa which is an acceptable limit to be applied as structural material. A review by [6] has found that after [2], researches have been reported by [8] and [3] on the compressive strength study of TSPC. However, there was insufficient information on the tensile strength of TSPC. Therefore, the purpose of this article is to examine the splitting tensile strength of TSPC through experimental.

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