EVALUATION OF THE HYDROGEN COMPATIGILITY OF MATERIAL: A COMPARISON WITH DIFFERENT METHODOLOGIES

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Key Words: Slow strain rate tensile test, Small punch test, Disc pressure test, Hydrogen embrittlement index, Crack

Different methodologies have been employing to estimate mechanical properties of metallic materials under the effect of hydrogen. The most well-known technique is the uniaxial tensile test performed under a very slow strain rate condition, the so-called slow strain rate tensile test (SSRT) [1]. However, a large amount of material and hydrogen is often required to machine the standard specimen. In certain situations, the applications of miniaturized specimens to assess the hydrogen compatibility is becoming popular, especially when there are volume constraints limiting the dimensions of the test samples. The small punch (SP) test that uses a thin disc is considered as the most promising and effective method to assess the degradation of the mechanical properties of materials [2]. Another test method that also uses a thin plate sample like the SP sample, the so-called disc test, but the methodology to evaluate the hydrogen susceptibility is different [3]. The main advantage of these experimental methods is that the testing samples can be taken from the structural component without impairing its structural integrity due to the size of the specimen. However, it seems to be noted that the higher level of hydrogen embrittlement susceptibility was often observed on the miniatured test method, directly using the miniatured test results to evaluate the hydrogen compatibility of the structural material or to assess the structural integrity of the hydrogen-exposed components seems too conservative [4]. Therefore, even though these experimental methods can provide a supportive screening technique for a quick evaluation/selection of the mechanical properties of materials, the use of the SP or disc test results need to be interpreted with more research attention. It is crucial to understand the fundamentals of each test method, the influence of test parameters, and the viability of empirical or analytical relations used to evaluate the hydrogen embrittlement index.

Reference:

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