

EVALUATION OF TENSILE PROPERTIES USING INSTRUMENTED INDENTATION TECHNIQUE FOR SMALL SCALE TESTING

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The Instrumented indentation technique (IIT) is a useful tool for estimating various mechanical properties such as tensile properties, fracture toughness, and residual stress by analyzing the load and depth curve. Unlike conventional test such as tensile test, CTOD, since IIT makes an indent with rigid indenter and measures load and depth continuously, it requires only a localized area and small area on the target material. IIT also has merits of simple specimen preparation and experimental procedure in terms of time and cost. Also, it can be applied to in-field structures nondestructively. In this study, we introduce a method for evaluating tensile properties, primary yield strength and tensile strength using representative stress-strain beneath the rigid spherical indenter through numerous investigations of instrumented indentation curves. Analytic models and procedures for estimating the mechanical characterization of materials using IIT are proposed. The representative stress-strain method directly correlates indentation stress and strain beneath indenter to true stress and strain of the tensile test by taking into account the plastic constraint effect. The experimental results from IIT were verified by comparing results from the uniaxial tensile test. In particular, the applications of IIT in small scale and localized area of materials are presented.

Reference

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