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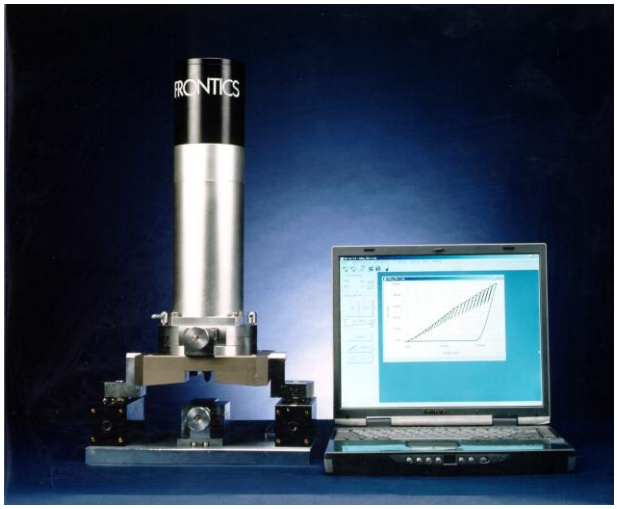
Advanced Indentation System 2000

Introduction

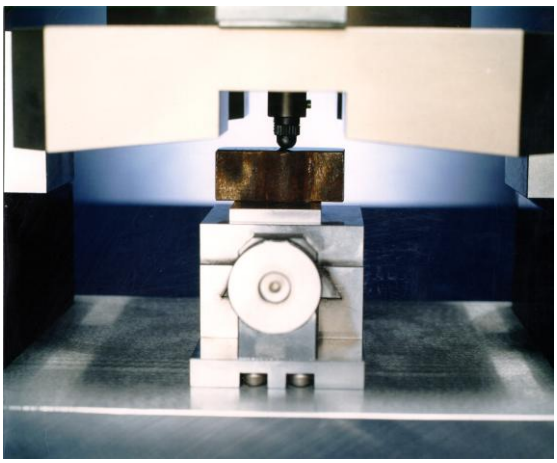


AIS 2000 is a portable indentation system for in-situ testing of in-service materials. It is light and miniaturized for easy and fast transportation and installation. AIS 2000 obtains precise continuous load and depth data. The obtained indentation load-depth curve can be converted to various tensile properties such as flow curve, yield strength, tensile strength and work-hardening exponent through the analysis software program loaded in the notebook computer. Software for residual stress evaluation is currently under development.

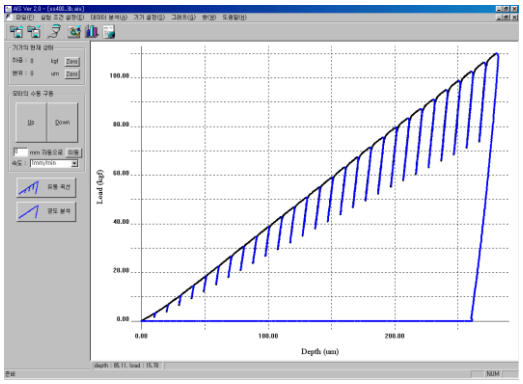
Basic Operating Principles

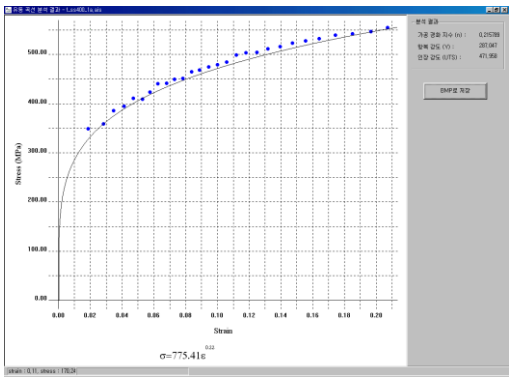
The indentation is made by applying the targeted load at test conditions set up previously through signal control of the AC servo motor, load sensor and displacement sensor for accurate movement.

The indentation depth is detected by the displacement sensor, which is designed to minimize such factors in testing error as deviation from vertical movement and compliance problems between indenter and displacement sensor.



You can obtain in-situ indentation load-depth curve during indentation test. Through the software program loaded in the notebook computer, mechanical properties such as flow curve, yield strength, tensile strength and hardness can be estimated simultaneously. In addition, changes in mechanical properties such as weldment/HAZ/base metal and local material degradation can be analyzed immediately by the superposition of the obtained curves.





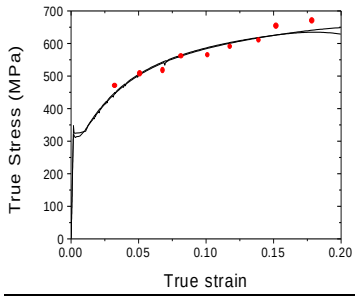
Specifications

- Max. Load: 300kgf
- Load Resolution: 0.3kgf
- Min. Loading Rate: 0.09mm/min
- Size: 180×180×430mm
- Max. Depth: 2mm
- Max. Indenter Movement Range: 20mm
- Displacement Resolution: 0.2㎛
- Weight(not including attachment): 15kg

- Impact Prevention Sensor
- Notebook Computer
- Standard Hardness Specimen
- 1mm dia. W Ball, Rockwell C, Vickers Indenter
- Magnetic/Mechanical Clamping Attachment

Mechanical Properties from S/W Program

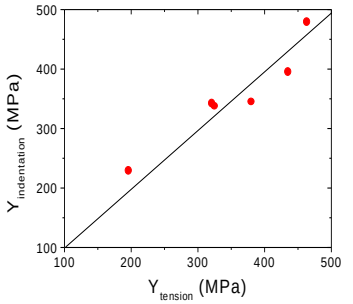
Flow Curve



SA203

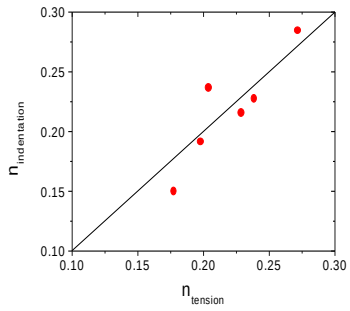
- Derivation of uniaxial tension curve from indentation deformation analysis
- Use of W ball indenter of 1mm diameter
- Definition of strain taking into account indenter shape and contact characteristics
- Definition of stress based on analysis of indentation stress field and constraint factor of plastic deformation
- Fast completion of test within 10min

Yield Strength



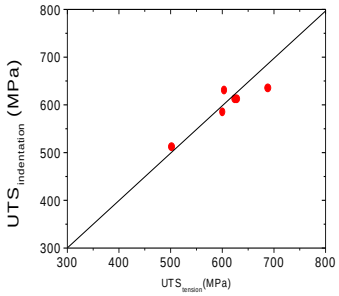
- Prediction of yield strength from flow curve obtained by indentation test (Less than 5% error in structural steels)
- No requirement of procedures for yield - point determination in standard tensile test
- Simultaneous evaluation with flow curve

Work-hardening Index



- Determination of work-hardening index through
- Holomon equation fitting from the evaluated stree/strain relationship
- Simultaneous evaluation with flow curve

Tensile Strength



- Prediction of tensile strength through the theoretical analysis of the evaluated flow curve (An error of less than 10%)
- Based on the theory that uniform elongation is consistent with work-hardening index
- Simultaneous derivation with flow curve

Special Features of AIS 2000

- Portable system with the high-performance motor/sensors and lightweight, high-strength frame
- Automated experiment procedure and integrated function program for user convenience
- Evaluation of strength properties including yield strength and tensile strength in the local region within 5mm^2 for use in welded joints and materials with the strength gradients
- Laboratory and field applications through using various attachments of flat and curvature magnetic attachments, U-block and universal mechanical chain
- Remote control available through added control part and notebook computer for full computer control of testing
- Inverter available for a supply of electric power from car battery in the field test
- Software package based on indentation stress-field theory for accurate evaluation and analysis of mechanical properties

Nondestructive, In-Situ and Localized Measurement

- Key mechanical properties of structures and facilities available in the field without a destructive tensile test
- Comparison of strength characteristics of weld/heat-affected-zone/base metal and local region with microstructure gradients
- Tensile properties of newly developed materials which cannot be manufactured as a standard tensile-test specimens
- Room-temperature and low-temperature mechanical properties of ferrous and nonferrous metals

Application Fields

- Degradation properties and lifetime evaluation of steam/nuclear power plant and gas and oil company facilities
- Evaluation of safety and fitness-for-service for industrial structure and facilities
- Quality control for car, ship, trains, and aircraft
- Pre-qualification tests of newly constructed structures/facilities
- Development of new alloy and alloy manufacturing process
- Provision of basic mechanical properties for FEM analysis of dissimilar materials
- Economical and fast quality control during production of metals processed goods