

**ADVANCED
TECHNOLOGY
CORPORATION**

Innovative SSM Technology

In-Situ Nondestructive Pipeline Testing

Measuring Tensile and Fracture Toughness Properties of Steels and Welds

Advanced Technology Corporation is an innovations and solutions driven company. After carefully listening to our customers, we respond to the needs by providing the most complete and cost-effective solution - not just provide technical services.

Since 1989 we have been providing SSM Systems, testing services, failure analysis, consulting, and R&D services to numerous international organizations. All of our clients have expressed great satisfaction with our products, services, and our efforts to meet their budgets and schedules.

Our innovative work is backed by the highest quality of published scientific research and the numerous years of experience by our talented staff. We don't make claims we can't support or promises we can't keep.

We will respond promptly to answer your fitness-for-service needs to assure the safe and efficient operation of your pipeline assets.

Solutions and Services:

- SSM/ABI Field Testing Services
- Complete Deterministic Structural Integrity Solutions
- API RP-579 Level III Fitness-for-Service Evaluation
- Failure Analysis and Prevention
- SSM/ABI Testing
- Nondestructive Field Testing
- Laboratory Testing
- Destructive Tensile
- Destructive Fracture Toughness
- Consulting
- R&D

Industries Served:

Oil and Gas Pipelines
Petrochemical
Automotive
Bridges
Ship and Submarine
Nuclear
Defense
Railroad
Aerospace

www.atc-ssm.com



Stress-Strain Microprobe® (SSM) System

U.S. Patent No. 4,852,397

The portable SSM System, using the Automated Ball Indentation (ABI) technique, is the only system that performs localized and nondestructive tests to measure actual key mechanical properties of metallic structures or very small volumes of material.

Award Winning Technology

In 1996 *R&D Magazine* selected the SSM technology to receive an R&D 100 Award as one of the most technologically significant products of the year.

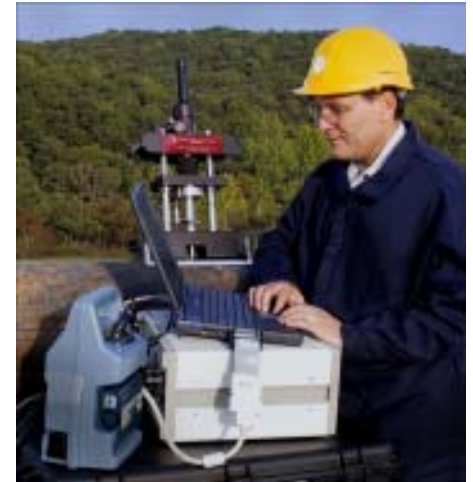
Key Mechanical Properties

- Yield strength
- True-stress/true plastic strain curve
- Strain-hardening exponent (n)
- Strength coefficient (k)
- Uniform ductility
- Ultimate strength
- Fracture toughness values
- Reference temperature and fracture toughness master curve of ferritic steels in the transition temperature region

Field Testing Services

ATC offers in-situ **ABI** field testing services to **nondestructively** measure tensile and fracture toughness properties of aging infrastructures, including in-service pipelines, when destructive testing is inappropriate, impossible, or too costly.

We perform ABI testing using our miniature/In-Situ SSM systems, so there is no need to cut sections of the pipeline and lose transmission service. In-situ ABI testing eliminates hot-tapping and machining of conventional (destructive) tensile and fracture test samples. Moreover, we are able to test all grades and heats of the pipeline including the base metal and welds to meet all CFR regulations according to the total length and location class of the pipeline.



Fitness-for-Service

For a complete deterministic structural integrity analysis (API RP-579 Level III) you need three pieces of information:

- 1 maximum transmission pressure,
- 2 crack size,
- 3 tensile and fracture toughness properties.

Crack size is determined by either in-line (smart-pigs) or off-line (hand-held ultrasonic devices) inspections.

Tensile and fracture toughness properties are measured by the nondestructive ABI test or by destructive testing which is cost prohibitive for long sections of pipelines.

The SSM/ABI technique compliments and augments other NDE technology to save you time and money.

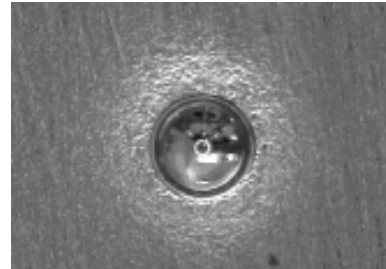
Without SSM/ABI testing you cannot have a total and cost-effective **deterministic pipeline integrity assessment**.

Tensile and Fracture Toughness in one test

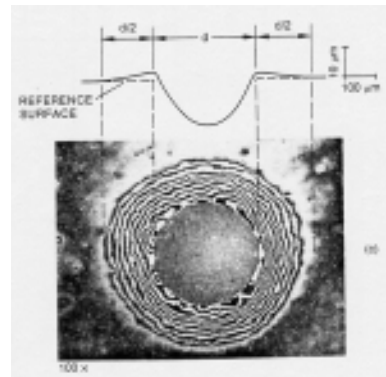
The **nondedestructive and in-situ ABI test** accurately measures both tensile and fracture toughness properties.

The ABI test technique is:

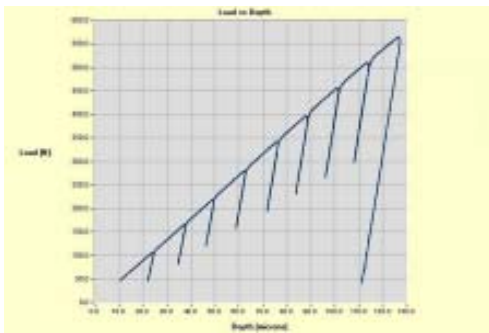
- simple
- accurate
- rapid (less than two minutes for a complete ABI test)
- economical
- highly reproducible



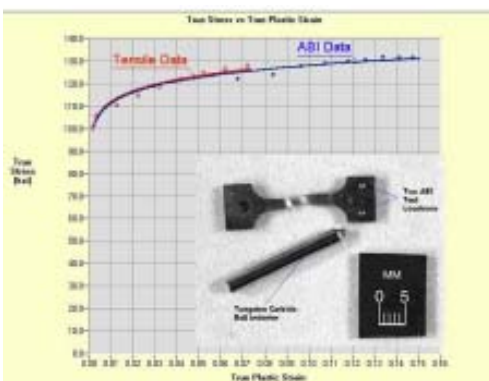
Indentation made with a 0.76-mm (0.030-in) diameter indenter. (Diameter = 0.53 mm (0.021 in). Maximum Depth = 0.13 mm (0.005 in))



Profilometer trace and interferograph made in a 1015 steel.

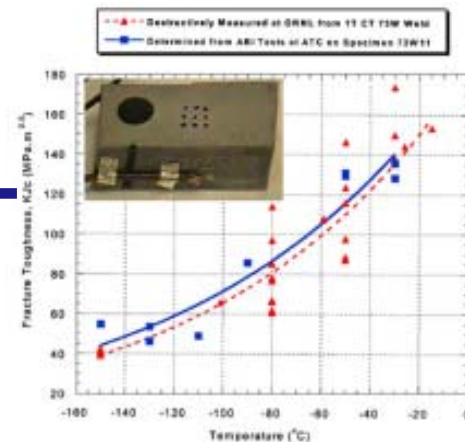


ABI-measured load versus depth data using a 0.76-mm (0.030-in) diameter tungsten carbide indenter on X52 pipeline steel material.



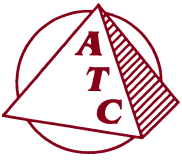
The ABI-measured True-Stress versus True-Plastic-Strain curve is in excellent agreement with the curve from the destructive tensile test on a high-strength steel material.

The incremental values of stress and strain are determined from the incremental values of ABI load and depth measurements using elasticity and plasticity theories.



The ABI-measured fracture toughness values and their median curve are in excellent agreement with those from the destructive test samples of base metal and welds.

The solid square data are determined from the tri-axial indentation deformation energy and the critical fracture stress of the steel material.



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Benefits of Nondestructive SSM/ABI In-situ Testing Include:

- Complement your NDE/Smart Pig inspection with SSM/ABI tensile and fracture toughness properties;
- Apply API RP-579 Level III Fitness-for-Service;
- Produce effective pipeline integrity management plans
- Comply with new regulations for safe operation;
- Meet increased energy demands by safely uprating the transmission pressure of your oil and gas pipelines;
- Verify grade certifications for new or existing pipelines;
- Quantify the quality / integrity of your welds (e.g. girth, ERW) or repair

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