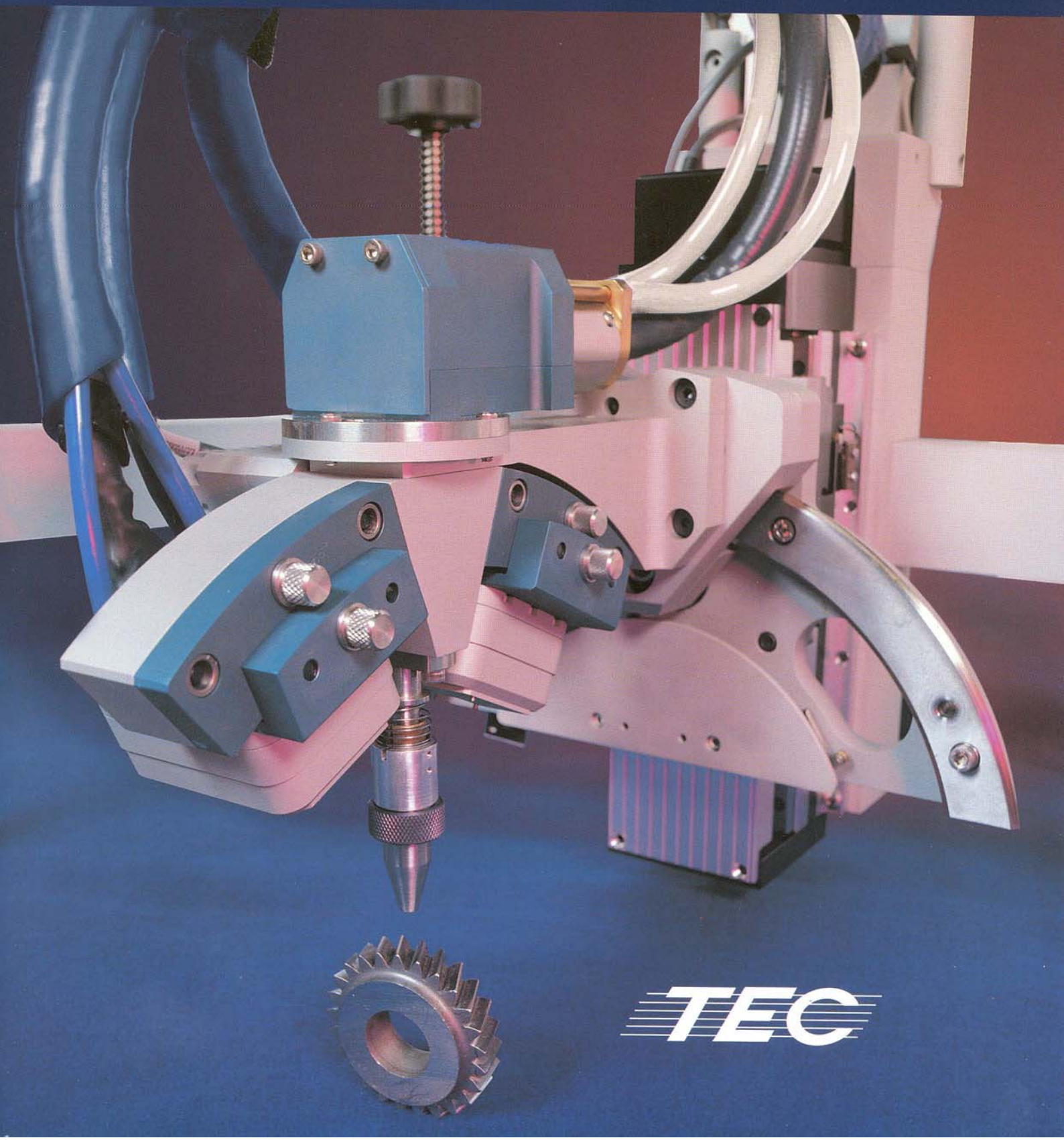
The TEC 4000
X-Ray Diffraction System



TEC

Why X-Ray Diffraction?

All manufacturing processes such as welding, casting, heat treating, grinding, electroplating, quenching, machining, and shot peening create residual stresses in materials that can cause defects and premature failures in materials and components.

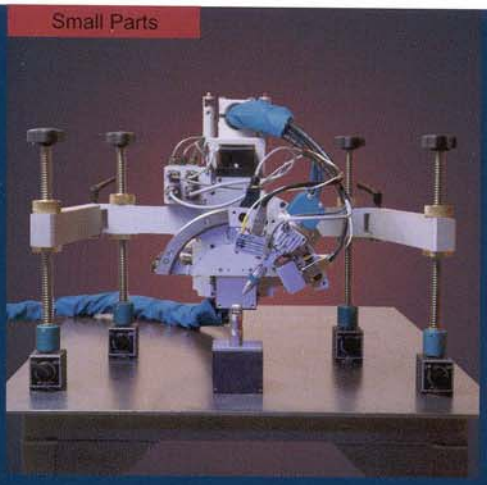
Residual Stresses - Directing an x-ray beam onto a crystalline material, whether it is metal or ceramic, causes the beam to be diffracted, creating an observable peak. The process is called x-ray diffraction. If the material is stress free, the peak occurs at a specific known angle depending on the wavelength of the x-ray and the material being analyzed. The diffraction peak is observed from several angles. If peak shifts appear at these angles, stresses are present. The degree and location of the shift provide data that allows you to calculate how much the atomic lattice structure of the material is either pulled apart (tensile stress) or pushed together (compressive stress). X-ray diffraction is the only *direct* method of measuring stresses in a material since the actual material is analyzed.

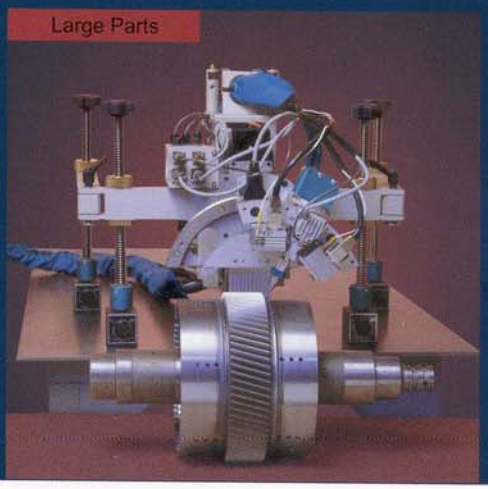
Retained Austenite - In addition to measuring residual stresses, x-ray diffraction is used to measure retained austentite content in steels. Austenite is a phase of steel that is critical to component lifetime and performance, especially in high-tolerance components such as bearings and gears. X-ray diffraction is the easiest way to measure retained austenite in steels and the only accepted method for detecting retained austenite content lower than 10%.

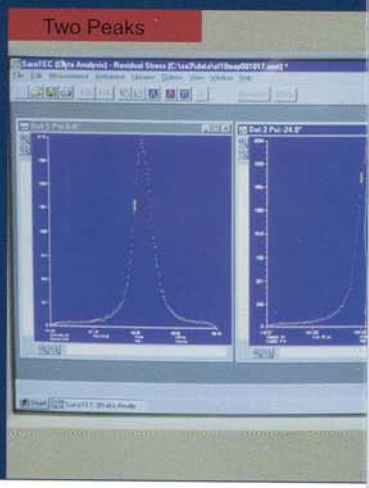
Applications - X-ray diffraction is used for many practical applications. In manufacturing environments, x-ray diffraction is used in applications such as determining the integrity of welds or manufactured components like bearings, gears, and springs. In the field, x-ray diffraction is used in applications that determine the soundness of large structures such as vessels, bridges, and pipelines. X-ray diffraction has been used to ensure quality and integrity in the manufacture of the external tank of the space shuttle.

The TEC 4000 X-Ray Diffraction System combines superior instrumentation for collecting x-ray diffraction data with the ability to analyze the data using TEC's exclusive SaraTEC™ software. For almost 20 years, many world-leading aerospace and automotive manufacturers have improved their processes and increased the quality of their products using TEC's x-ray diffraction systems.

Superior Flexibility and Spee







Mobile system brings the lab to the work for efficient measurements

The TEC 4000's centerless diffractometer attaches to the rest of the system by a 15-foot cable (longer lengths optional), accommodating measurements on components ranging in size from 0.5mm to as large as a bridge. The entire system is lightweight and portable, allowing you to perform measurements for maximum efficiency in the laboratory, on the shop floor, or in the field.

Dual detectors for swift, precis exposures

The TEC 4000 can operate with two detectors, saving time by measuring tw angles at once. The system can also o with just one detector if the geometry o part cannot accommodate two. The de provide superior signal-to-noise ratio fo precise measurements, so there is no for background subtraction as required PDA or CCD detectors. Detector expos times for steels are often under 10 sec

for Residual Stress and Retained Austenite Analysis

The TEC 4000 X-Ray Diffraction System

Flexible measurement orientations to accommodate unusual configurations

The detector(s) can be turned 90 degrees to enable measurements to be taken in either the Ψ or Ω orientations. This feature accommodates measurements on large or awkward component configurations and increases the flexibility of the TEC 4000.

Designed for ease of use, speed, flexibility, and portability, this compact system includes a diffractometer, control cabinet, and personal computer. The system's ergonomic design and sample autodistancing feature make it easy to set-up. The TEC 4000 system can operate with either one or two detectors and perform single, double, or multiple exposures for fast, accurate, flexible measurements. Measurement data is analyzed with TEC's user-friendly, Windows-based SaraTEC™ software that is included with the system. This compact system can perform in the laboratory, on the shop floor, or in the field. For even more portability, the personal computer can be easily replaced with a laptop computer.

TEC stress analyzers have been in continuous operation worldwide for almost 20 years. The TEC 4000 X-Ray Diffraction System combines TEC's proven accurate technique with streamlined adaptability in an instrument capable of performing anywhere, anytime.

Specifications

X-Ray Tube
Pre-aligned
30 KV/6.7mA/200W
Cr Tube is standard; other targets are optional (see below)
Quick changeout
Self-contained water cooling system
Automatic tube recognition
Integrated level for ease of setup

Collimators
Standard 1, 2, 3, 4, 5 mm circular
Optional 0.5, 1.0, 1.5, 2.0, 3.0, x 5.0 mm rectangular

Goniometer
Single-, double-, and multiple-exposure techniques
Psi-angle range -45° to +60°
Operates with 1 or 2 detectors
Operates in Ψ or Ω orientation
156° bracket(s) standard
Sample-to-detector distance: 3.55" (90.25 mm)
X-ray emission-to-sample distance: 0.81" (20.57 mm) nominal
Can be operated vertically or inverted
Standard quad leg table-top mount
Adjustable oscillation over entire psi-angle range
Automated sample-to-detector distancing

Detector(s)
Miniaturized PSD, approximately 2.5 times as efficient as CCD and PDA detectors (5.9 KeV x-rays)

CPU
Pentium III processor (minimum), 15" monitor, and color printer are standard

Software
Windows NT™. TEC's exclusive SaraTEC™ software with license; residual stress and retained austenite data acquisition menu; x-ray power control; goniometer control; set-up menu; full color spectra and spectra comparison display; d-spacing vs $\sin^2\Psi$ and intensity vs $\sin^2\Psi$; report displays; peak fit display; region of interest display; library of materials; x-ray tubes; collimators; penetration correction; depth analysis; batch processing; automated Ψ and Z movement; on-line help. Integrated X, Y, Φ automated movement optional.

Safety
Fail-safe system designed to meet the requirements of ANSI 43.2 for open-beam operation. Accepts almost any type of safety interlock such as light beam, floor mats, enclosure, tilt, beacon, and audible alarm. Tilt switch and light beam are standard; all others are optional.

Cables
High voltage, control, and cooling system cables; each 15 feet in length (4.57m). Optional longer cables available.

Electrical Power
110 VAC, 60 Hz; or 220 VAC, 50 Hz

Dimensions
Nominal - Cabinet 25"h x 26"d x 10"w; Goniometer 6"h x 7"d x 10.5"w, Quad Leg 12"h x 12"d x 20"w

Options
X-ray tubes Cu, Co, Fe, Mn, Mo, Ti, V
Automated X-Y Positioning Table
Automated Φ Rotation Table
Diffractometer Accessories:
Brackets 160°, 149°, 142°, 135°, 128°
Retained Austenite Bracket 78°, 106°, 128°, 156°
Rectangular Collimators 0.5, 1.0, 1.5, 2.0, 3.0, x 5.0 mm
25-foot cabling

TEC 4000 X-RAY DIFFRACTION SYSTEM

Maintenance Service Agreements Available

TEC Materials Testing Division - 10737 Lexington Drive, Knoxville, TN 37932 USA - Telephone 865-966-5856 - Fax 865-675-1241 - Web www.tecstress.com