

X-RAY DETECTOR

XR-100CR

**No Liquid Nitrogen
Solid State Design**

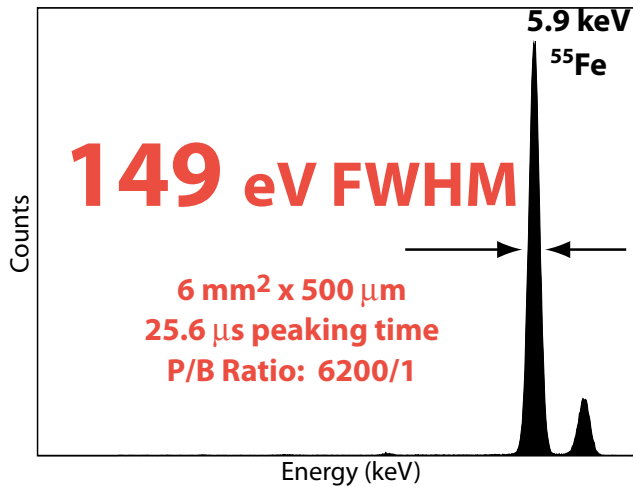
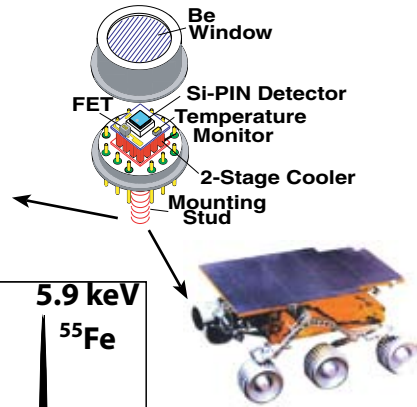
**High Performance at
Low Cost**

FEATURES

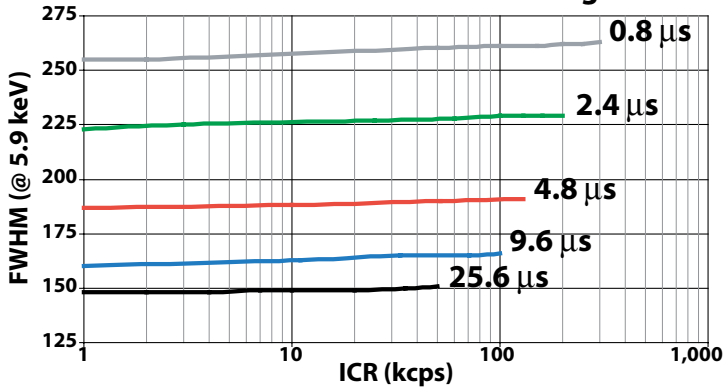
- Si-PIN Photodiode
- Thermoelectric Cooler
- Beryllium Window
- Hermetic Package (TO-8)
- Wide Detection Range
- Easy to Operate

APPLICATIONS

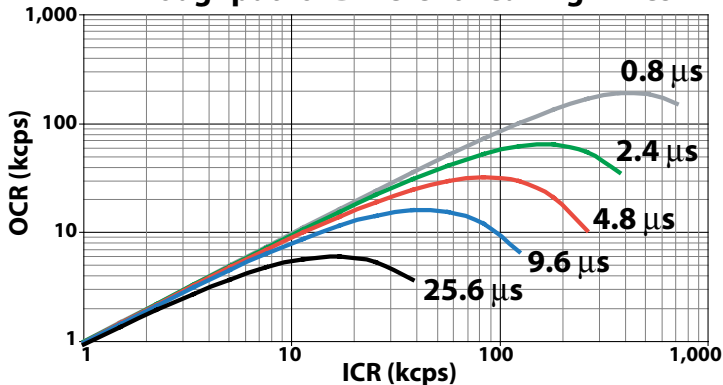
- X-Ray Fluorescence
- OEM
- Process Control
- RoHS / WEEE Compliance
- Portable Instruments
- Art & Archaeology
- Teaching & Research
- Lead Detectors
- Space and Astronomy
- Environmental Monitoring
- Nuclear Plant Monitoring
- Heavy Metals in Plastic
- Semiconductor Processing
- Plating Thickness
- Sulfur in Oil & Coal Detection
- Smoke Stack Analysis
- Coal & Mining Operations
- Jewelry Analysis
- Forensic Investigations



Resolution vs. ICR for Different Peaking Times



Throughput for Different Peaking Times



Model *XR-100CR* is a high performance X-Ray Detector, Pre-amplifier, and Cooler system using a thermoelectrically cooled Si-PIN Photodiode as an X-Ray detector. Also mounted on the 2-stage cooler are the input FET and a novel feedback circuit. These components are kept at approximately -55°C, and are monitored by an internal temperature sensor. The hermetic TO-8 package of the detector has a light tight, vacuum tight thin Beryllium window to enable soft X-Ray detection.

Power to the XR-100CR is provided by either the PX2CR or the PX4. The PX2CR is AC powered and includes a spectroscopy grade Shaping Amplifier with fixed time constant (6 µs, 12 µs, or 20 µs). The PX4 is DC powered by an AC adaptor and provides both a variable Shaping Amplifier (.25 ns to 40 µs) and the MCA function.

The XR-100CR/PX2CR or XR-100CR/PX4 system ensures stable operation in less than one minute from power turn-on.

The resolution for the 5.9 keV peak of ⁵⁵Fe is 145 eV FWHM to 260 eV FWHM depending on the detector type and shaping time constant (see next page for selection guide).

SPECIFICATIONS

GENERAL	
Detector Type	Si-PIN
Detector Size	5 mm ² to 25 mm ² . See Selection Guide.
Silicon Thickness	300 μm, 500 μm, 680 μm
Energy Resolution @ 5.9 keV, ⁵⁵ Fe	145 eV FWHM to 230 eV FWHM depending on detector type and shaping time constant. See Selection Guide.
Background counts	<3 x 10 ⁻³ /s, 2 keV to 150 keV for 7 mm ² / 300 μm detector
Be Window	1 mil (25 μm), or 0.5 mil (12.5 μm) thick
Charge Sensitive Preamplifier	Amptek custom design with reset though the H.V. connection
Gain Stability	<20 ppm/°C (typical)
Case Size	3.00 x 1.75 x 1.13 in (7.7 x 4.4 x 2.9 cm)
Weight	4.4 ounces (125 g)
Total Power	<1 Watt
Warranty Period	1 year
Typical Lifetime	5 to 10 years, depending on use
Storage Time	10+ years in dry environment
Operation Conditions	0°C to +40°C
UL Certified	Certificate #: CU 72072412 01 Tested to: UL 61010-1: 2004 R7 .05 CAN/CSA-C22.2 61010-1: 2004
OPTIONS	
Detector sizes from 5 mm ² to 25 mm ² (300 μm to 680 μm thick). See Selection Guide.	
Other Beryllium window thicknesses are available on special order (0.3 mil - 7.5 μm).	
See also XR-100SDD specifications using Silicon Drift Detectors.	
See also XR-100T-CdTe specifications using Cadmium Telluride (CdTe) diode detectors for high efficiency and high resolution Gamma Ray detection (<1 keV FWHM @ 122 keV, ⁵⁷ Co).	
Collimator Kit for high flux applications.	
INPUTS	
Preamp Power	±8 to 9 V @ 15 mA with <50 mV peak-to-peak noise.
Detector Power	+100 to +200V @ 1 μA depending on detector type; <0.1% variation.
Cooler Power	Current = 350 mA maximum Voltage = 4 V maximum with <100 mV peak-to-peak noise Internal temperature controller
OUTPUTS	
Preamplifier Sensitivity	1 mV/keV typical (may vary for different detectors)
Polarity Feedback	Negative Signal Out, 1 kΩ max. load Reset through the detector capacitance

Temperature Monitor Sensitivity	PX2CR: 770 mV = -50 °C PX4: direct reading in K through software
CONNECTORS	
Preamp Output	BNC coaxial connector
Power and Signal	6-Pin LEMO connector
Interconnect Cable	To PX2CR: 6-Pin LEMO 9-Pin D, 5 ft length To PX4: 6-Pin LEMO to 6-Pin LEMO, 5 ft length
6-PIN LEMO CONNECTOR	
Pin 1	Temperature monitor diode
Pin 2	+ H.V. Detector Bias, +100 - 200 V max.
Pin 3	-9 V Preamp Power
Pin 4	+9 V Preamp Power
Pin 5	Cooler Power Return
Pin 6	Cooler Power: 0 to +4 V @ 350 mA
CASE	Ground and Shield

AMPTEK XR-100 Selection Guide

Detector Type Area/Thickness Be Window Thickness Options	Guaranteed Energy Resolution eV FWHM @ 5.9 keV* Peak to Background Ratio**
<i>The following detectors are fully depleted and contain a Multilayer (ML) Internal Collimator.</i>	
Si-PIN 6 mm ² / 500 μm 0.5 or 1.0 mil Be	145 - 170 eV 32 μs Peaking Time P/B Ratio: 6200/1
SDD 7 mm ² / 450 μm 0.5 or 1.0 mil Be	135 - 150 eV 9.6 μs Peaking Time P/B Ratio: 7000/1
Si-PIN 13 mm ² / 500 μm 1.0 mil Be	180 - 210 eV 32 μs Peaking Time P/B Ratio: 4100/1
Si-PIN 25 mm ² / 500 μm 1.0 mil Be	190 - 230 eV 32 μs Peaking Time P/B Ratio: 2000/1
SUPER SDD 25 mm ² / 500 μm 0.5 mil Be	127 - 140 eV 11.2 μs Peaking Time P/B Ratio: 8000/1
<i>The following detectors are partially depleted and contain no internal collimator. Recommended for use between 1.5 and 8 keV</i>	
Si-PIN 7 mm ² / 300 μm 1.0 mil Be	165 - 185 eV 44.8 μs Peaking Time P/B Ratio: 250/1 (5000/1 with external collimator)
Si-PIN 13 mm ² / 300 μm 1.0 mil Be	200 - 220 eV 44.8 μs Peaking Time P/B Ratio: 550/1 (4000/1 with external collimator)
*Peaking Time is approximately 2.4x shaping time.	
**The Peak to Background (P/B) Ratio is the ratio of the counts at the 5.9 keV to 2 keV.	

For full system specifications, please see <http://www.amptek.com/xr100cr.html>

APPLICATIONS

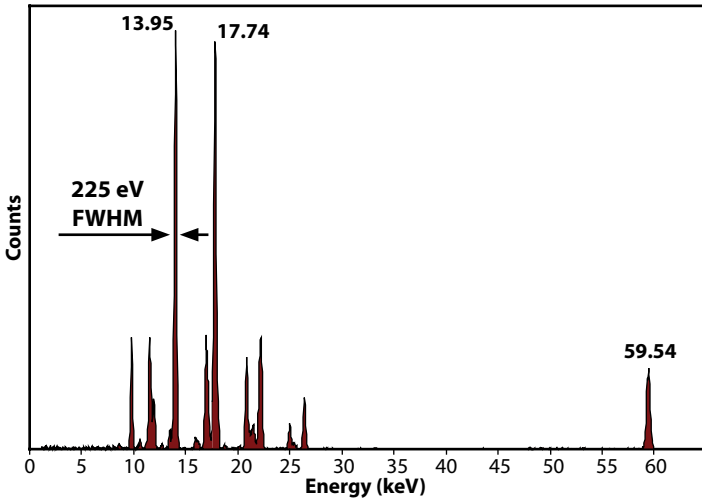


Figure 1. ²⁴¹Am Spectrum



Figure 2. XR-100CR Taking an X-Ray Fluorescence Spectrum of Michelangelo's David

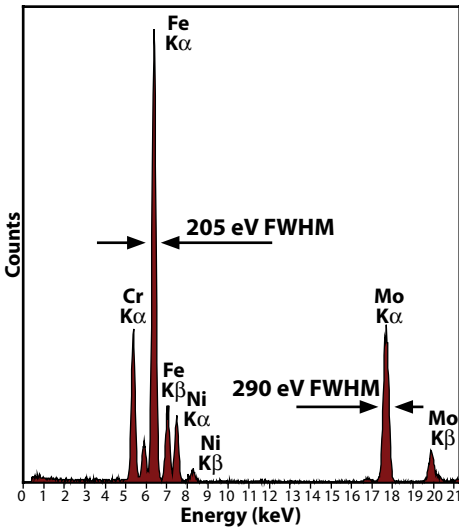


Figure 3. SS316 Fluorescence from ¹⁰⁹Cd

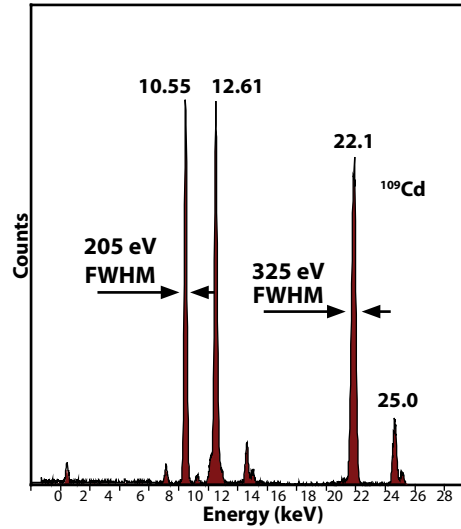


Figure 4. Lead (Pb) Fluorescence from ¹⁰⁹Cd

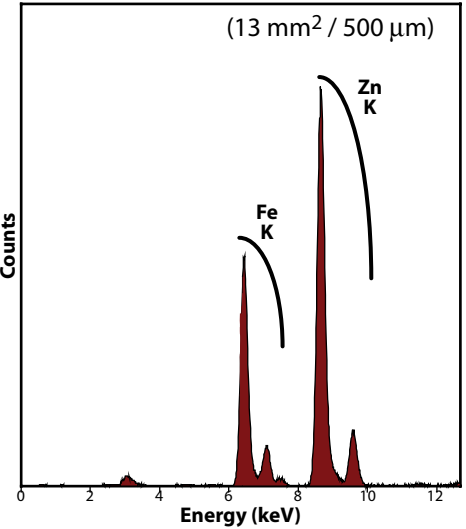


Figure 5. Process Control. Galvanized Steel: Zinc (Zn) plating on Iron (Fe)

RoHS / WEEE Solutions

Spectrum of Chromium, Lead and Cadmium



Figure 6. X-123 X-Ray Spectrometer that accepts all Amptek detector sizes.

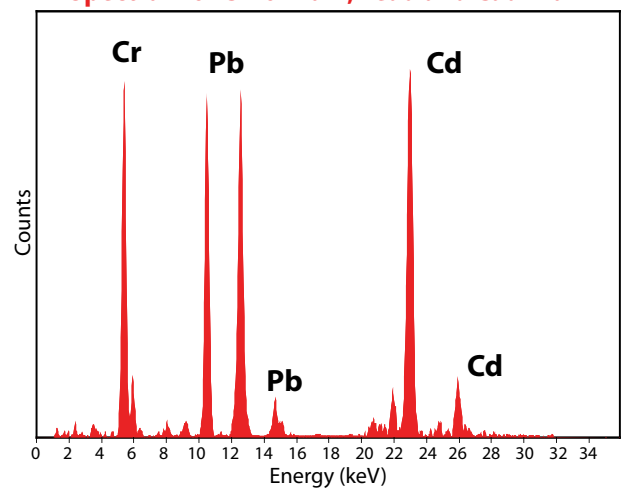


Figure 7. Chromium (Cr), Lead (Pb), and Cadmium (Cd).

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APPLICATIONS

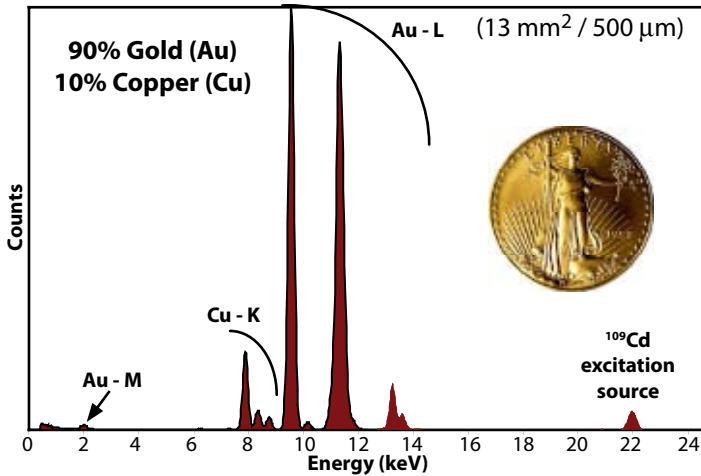


Figure 8. Saint Gaudens US \$20 gold coin with 90% Gold (Au) and 10% Copper (Cu).

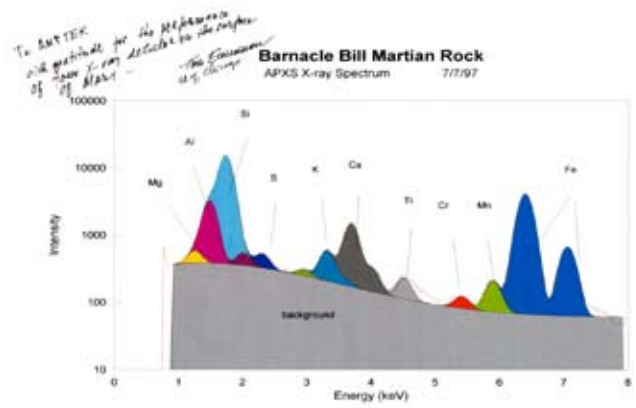


Figure 9. First Rock Spectrum from Mars

For its unique design and reliability, the XR-100 was selected for the Pathfinder Mission to perform rock and soil analysis using x-ray fluorescence techniques. Spectrum courtesy of the University of Chicago.

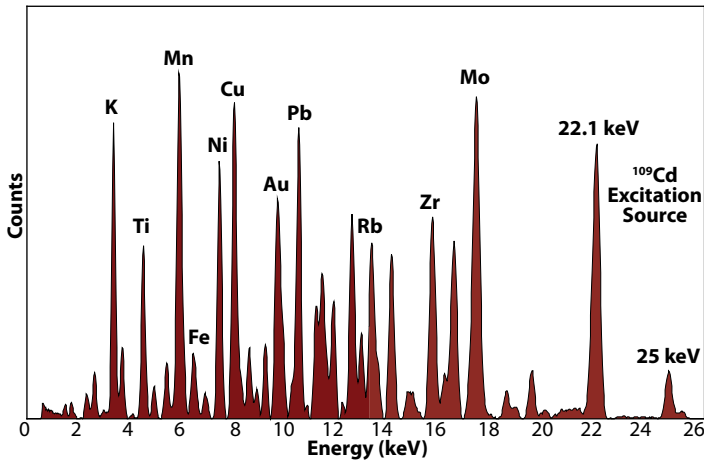


Figure 10. Multi-Element Fluorescence from ¹⁰⁹Cd

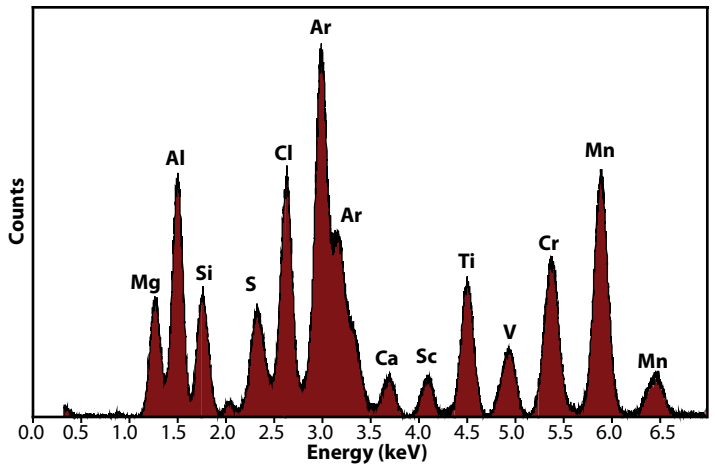


Figure 11. Low Element Fluorescence with 6 mm²/500 mm Detector

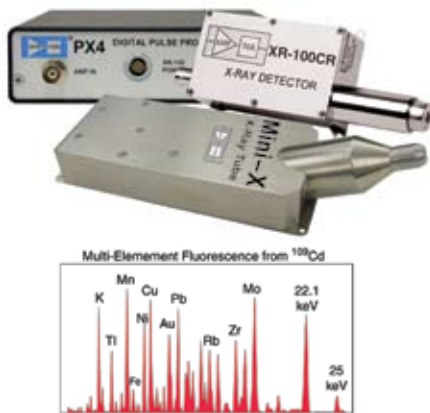


Figure 12. Complete XRF System: XR-100CR and PX4 Digital Pulse Processor and MCA, Mini-X X-Ray Generator System, and XRF-FP Quantitative Analysis Software

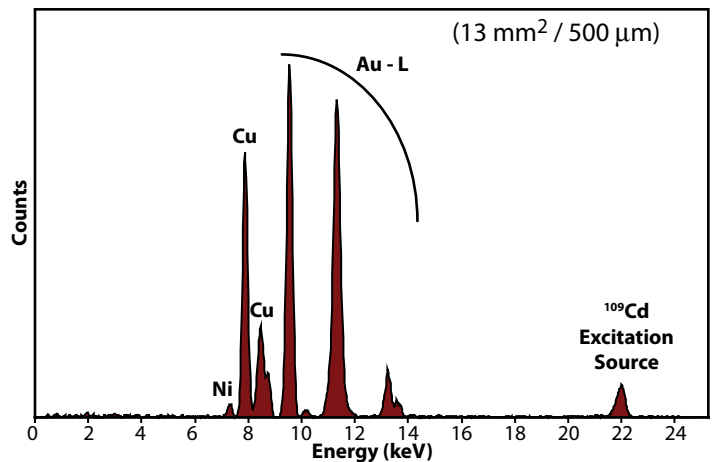
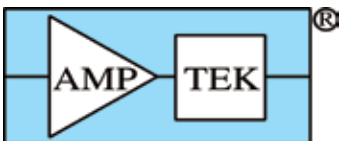


Figure 13. Jewelry analysis of a 14k Gold/White Gold (Au) chain containing Copper (Cu) and Nickel (Ni).



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