

Product Information

200 kV ROTATING ANODE TYPE HIGH ENERGY X-RAY GENERATOR

1. Introduction

The X-ray wavelength used for X-ray diffraction is selected based on the sample composition and the type of analysis desired. Choice of wavelength is determined by the ability to reduce fluorescence and thereby background, the 2θ range of the diffraction pattern, and the penetrability of the sample. X-ray target materials used include Cu, Ag, Mo, W as well as others. Wavelengths of Mo and Ag are shorter than that of Cu making them more penetrating and thereby appropriate for measurement of samples having large absorption coefficients.

The recent growing demand for continuous X-rays with higher intensity than $AgK\alpha$ or $MoK\alpha$, such as $WK\alpha$, has led to the introduction of Rigaku's 18 kW rotating anode type 200 kV high energy X-ray generator.

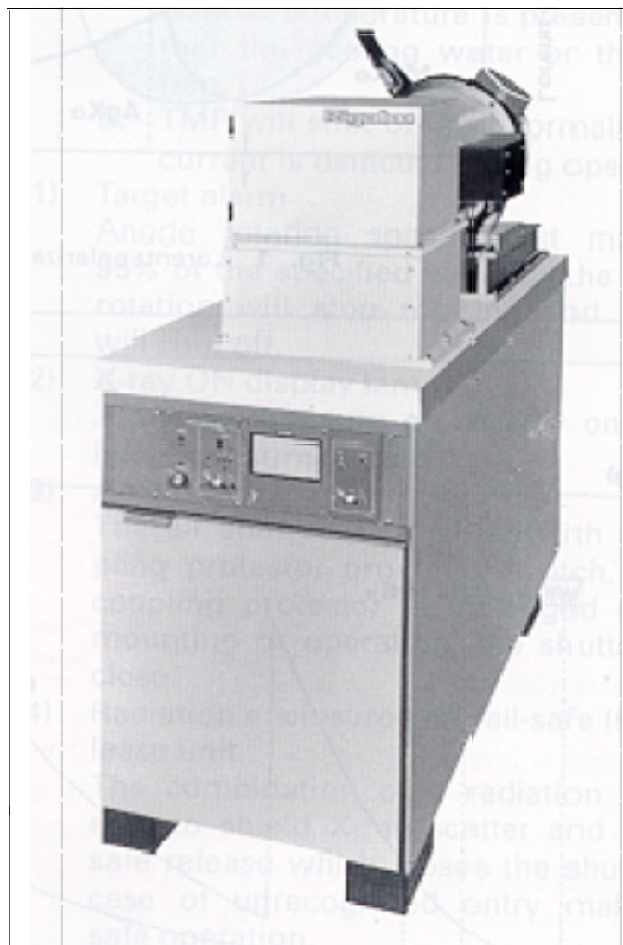
2. Features

(1) The maximum voltage is 200 kV for the Mo and W targets. With a W target, it is possible to attain an applied voltage three times that of the excitation voltage for $WK\alpha$ radiation, which is 69.3 keV.

	18 kW rotating anode type			
Target Material	Au	W	Ag	Mo
Max. permissible voltage (kV)	160	200	100	200
Max. permissible load (kW)	12	18	12	18

Note: When the focal spot size is 1 X 10 mm²

(2) With $WK\alpha$ radiation, a Lorentz polarization value ($\sin \theta/\lambda$) can be used which is several times greater than the average for Mo or $AgK\alpha$. The resulting diffraction spot will be several times larger than that of $MoK\alpha$ or $AgK\alpha$. In other words, a diffraction spot due to $WK\alpha$ radiation can be obser-



ved in a scale several times larger on the average than those spots due to $MoK\alpha$ and $AgK\alpha$ radiations. As a result, what has so far been difficult for detection is now clearly detectable. (Fig. 1)

(3) $WK\alpha$ radiation allows a notably small absorption coefficient for samples. (Fig. 2)

Note: Data (2), (3) by courtesy of Dr. Fujio P. Okamura at National Institute for Research in Inorganic Materials, Science and Technology Agency of Japan. Dr. Okamura described $WK\alpha$ radiation in detail in his article carried in The Rigaku Journal Vol. 11, No. 2. The above data appeared in that article.

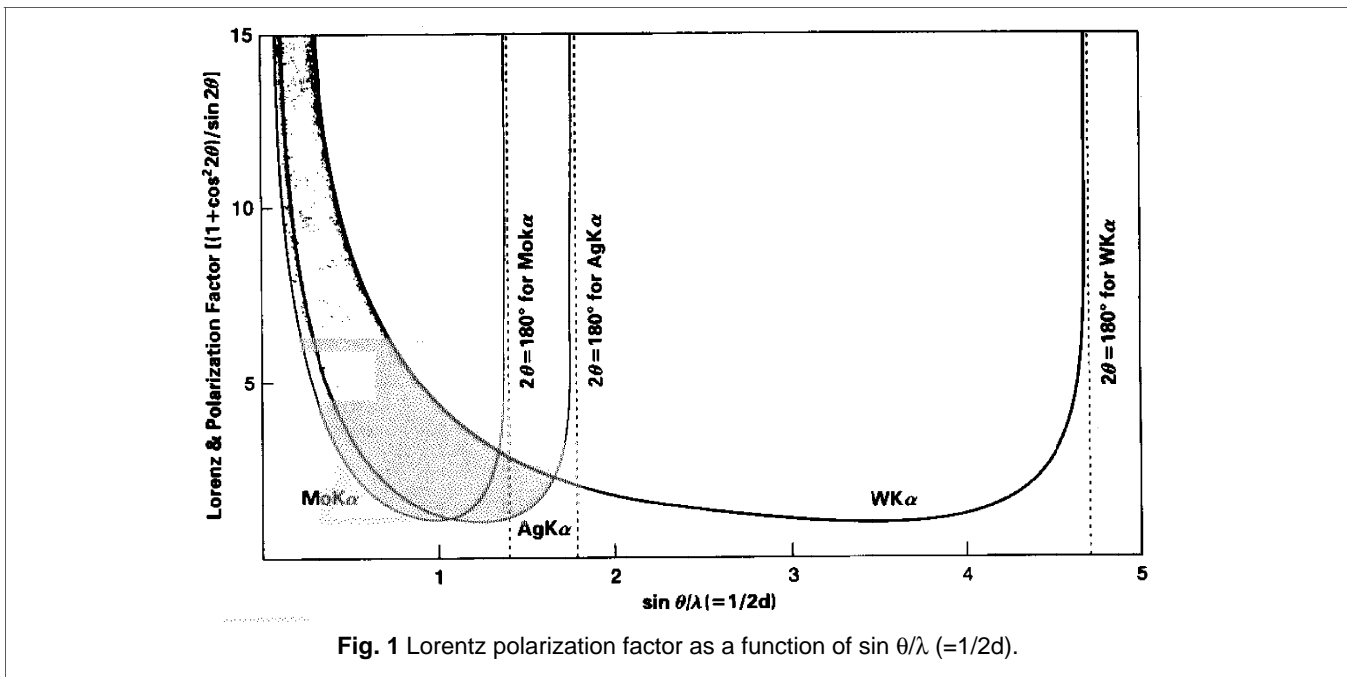


Fig. 1 Lorentz polarization factor as a function of $\sin \theta/\lambda (=1/2d)$.

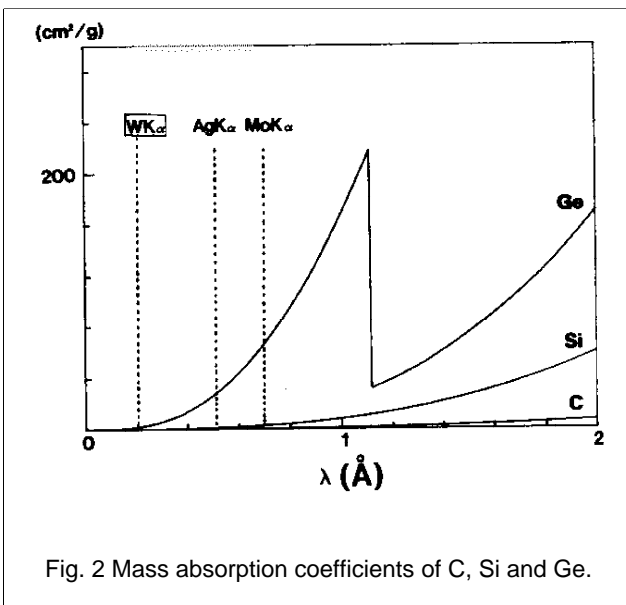


Fig. 2 Mass absorption coefficients of C, Si and Ge.

3. Application

The X-ray source for: (1) Single crystal structure analysis (2) Fluorescent X-ray analysis (3) Precision analysis of electron density distribution

4. Specifications

4.1 External Dimensions (Unit.- mm)

- (1) Basic unit : Approx. 580 W. x 1300 D. x 1400 H.
(table top height: 900, X-ray source height: 1200)

- (2) Controller : Approx. 535 W. X680 D. x 1800 H.
- (3) H.V.transformer : Approx. 890W x 1660 D x 1500 H.

4.2 Weight

- (1) Basic unit: Approx. 750 kg
- (2) Controller: Approx. 180 kg
- (3) H. V. Transformer: Approx. 3500 kg

4.3 Power Supply

- (1) Basic unit: 3-phase 200 V AC, 25A
- (2) Controller: Single phase 200 V AC, 120 A

4.4 Max. Rated Output: 200 kV-90 mA, 18 kW

4.5 X-ray Tube Voltage-Current Variable Range

- (1) Tube voltage : 49 kV~200 kV
Coarse adjustment: in 20 kV steps, variable
Fine adjustment: in 2 kV steps, variable
- (2) Tube current: 2mA~100mA, continuously variable

4.6 X-ray Tube Voltage-Current Stability

- (1) Variation for mains: Within $\pm 0.1\%$ (for within $\pm 10\%$ mains variations)
- (2) Variation for temp. Within $\pm 0.1\%$ (for within 65°C variations in ambient 10 to 25°C range)

(3) Long term stability: Within $\pm 0.1\%$

(4) Setting reproducibility: Within $\pm 0.1\%$

4.7 Focal Spot Size:

Real focus: $1 \times 10 \text{ mm}^2$ (on target) Effective focus at 6° takeoff angle: $1 \times 10 \text{ mm}^2$ (Take-off direction: Point focus taken out in a horizontal, lateral direction: One direction only)

4.8 Permissible Load for Targets (options) at $1 \times 10 \text{ mm}$ focal spot size

Cu, Mo, W:	18 kW
Ag :	12 kW
Cr, Co, Au:	10 kW
Fe:	9 kW

4.9 Vacuum System

(1) Fully automatic pumping (with a selector switch for automatic/ manual pumping)

(2) Auxiliary vacuum system

Motor direct-coupled rotary pump (RP)

(3) Main vacuum system

Turbomolecular pump (TMP)

(4) Vacuum degree deciding device (vacuum switch)

Ion gauge (IG)

4.10 Safety Device

(1) Line current limiter (LCL)

X-rays will shut off if current reaches 20% over the maximum rated current.

(2) High voltage limiter (HVL)

X-rays will shut off if the tube voltage exceeds 220 kV.

(3) Tube current limiter (TCL)

X-rays will shut off if the tube current exceeds 110 mA.

(4) Overload limiter (OLL)

X-rays will shut off if total power reaches 10% over the set load.

(5) Transformer oil temperature (TT)

X-rays will shut off if the insulation oil temp. of the H.V. transformer rises above the set value.

(6) Low voltage limiter (LVL)

X-rays will shut off if the tube voltage fails to reach 40 kV after X-rays are turned on.

(7) Filament current limiter (FCL)

X-rays will shut off if an excessive current flows to the filament.

(8) Filament coil shutter (FCS)

X-rays will shut off if the filament fails during operation.

(9) Vacuum alarm

If the pressure inside the tube is higher than the set value at LOW, the IG will shut down and shut off X-rays. X-rays will not turn back unless the pressure remains below the set value at HIGH.

(10) TMP alarm

a. TMP will shut off and disable if abnormal temperature is present in either the cooling water or the system.

b. TMP will shut off if abnormally high current is detected during operation.

(11) Target alarm

Anode rotation speed must maintain 95% of the specified value or the anode rotation will stop rotating and X-rays will shut off.

(12) X-ray ON display lamp

X-ray will not turn on or stay on if the lamp has burned out.

(13) Air shutter

The air shutter is provided with a coupling protector proximity switch. If the coupling protector is dislodged during mounting or operation, the shutter will close.

(14) Radiation enclosure and fail-safe (FS) release unit

The combination of a radiation enclosure to shield X-ray scatter and a fail-safe release which closes the shutter in case of unrecognized entry make for safe operation.

4.11 Lamp Display

(1) Red

a. Display of X-ray hazards... X-RAY ON, SHUTTER OPEN

b. Alarm display when a safety device is triggered

(2) Green

a. Display of normal operation... TMP RUN, VAC. OPERATE

b. Display of vacuum regions

(3) Orange and yellow (or transparent)

a. Display of connection to power supply ... LINE, POWER

b. READY display