

Development of the GSK 2001 X-ray Crystal Fluorescence System

G. S. Knapp

GSK X-RAY, San Jose, CA, U.S.A.

Introduction

In collaboration with the BESSRC staff, GSK X-RAY has tested a prototype of the system shown in Fig. 1. This work led to the further development of the system. The system has a very large solid angle, almost unlimited count-rate capabilities; it is easy to set up; and it is quite inexpensive.

Instrument Description

GSK 2001 Crystal Fluorescence Systems are intended to be used for x-ray absorption fine structure (XAFS), microfluorescence, small angle scattering (regular and anomalous), and powder diffraction (regular and anomalous) measurements (Tables I and II). The crystal assemblies and Soller slits mount on the customer's equipment.

Acknowledgment

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Table I.

Item	Offset (°)	Thickness (μ)	Energy Ranges (keV)	Elements	Reflection
1	11.0	15	4.1-4.5	Sc, Ti, Cs, Ba	111
2	14.0	20	5.2-5.9		111
3*	18.3	30	6.2-7.4, 9.5-11.2	Fe, Co, Ni, Dy-Lu, Ga, Ge, As, Se, Ir-Bi	111 220
4*	21	40	7.5-10	Ni, Cu, Zn, Ga, Ge Lu-Ag	111 220
5	14.0	90	11-17.5	Se-Y, Th-Am	220
6	7.7	90	17.5-30	Rh-Cs	220

*These crystals can be used with both 111 and 220 reflections. The reflections divert the beam in opposite directions, so by rotating the assembly 180°, the other energy range can be used.

Table II.

System specifications	
In-plane acceptance*	0.22-0.5 radians
Out-of-plane acceptance	0.1 radians
Efficiency	15-25% depending on energy
Maximum count-rate of detected signal	Limited only by detector
Resolution	15 V at 10 keV
Signal to background	Very high

*In the center of the energy range of each crystal, the beam will hit the crystal at 90°. This gives an in-plane acceptance limited only by the size of the crystal. At the limits of the energy ranges, aberrations decrease the acceptance to 0.22 radians.

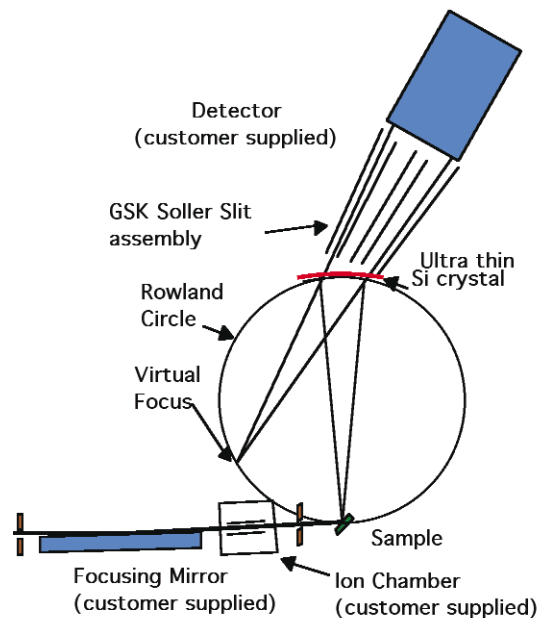


FIG. 1. Crystal assemblies for the GSK X-RAY 2001 crystal fluorescence system.

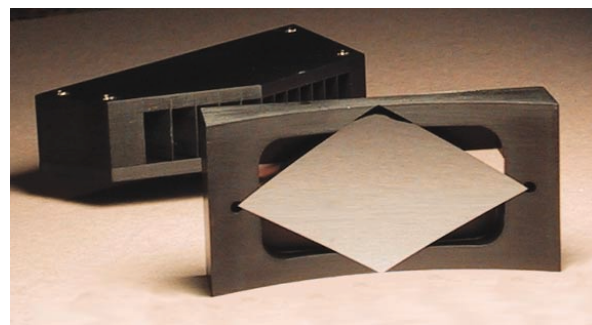


FIG. 2. The GSK X-RAY crystal and Soller slit assemblies. The crystal is 44 mm x 76mm.