

Wavelength-Dispersive XRF

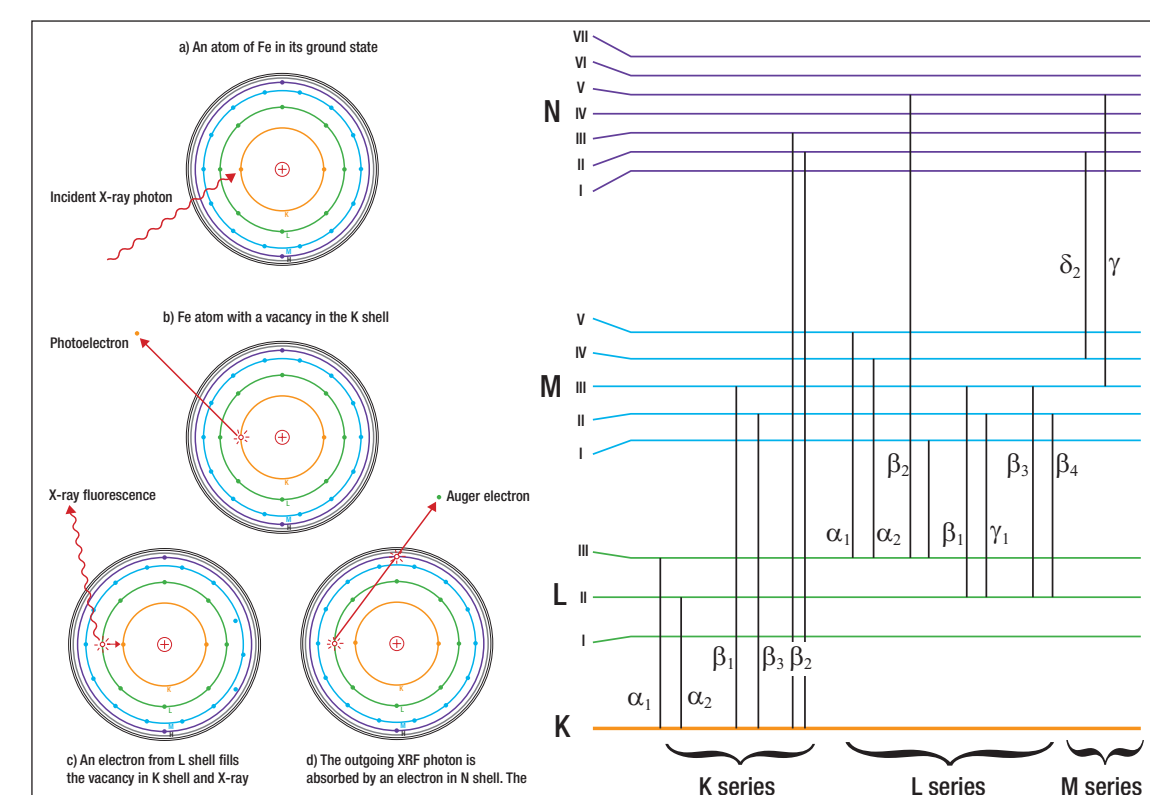
Crystals and Detectors Guide

| | | | | | | | | | | | | | | | | | | | | | | | | |
|----|-----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|------|-----|----|-----|------|-------------|----|----|
| IA | IIA | | | | | | | | | | | | | | | | IIIA | IVA | VA | VIA | VIIA | INERT GASES | | |
| 1 | 2 | | | | | | | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2 | 3 | | | | | | | | | | | | | | | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 3 | 4 | | | | | | | | | | | | | | | | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 4 | 5 | | | | | | | | | | | | | | | | 6 | 7 | 8 | 9 | 10 | | | |
| 5 | 6 | | | | | | | | | | | | | | | | 7 | 8 | 9 | 10 | | | | |
| 6 | 7 | | | | | | | | | | | | | | | | 8 | 9 | 10 | | | | | |
| 7 | 8 | | | | | | | | | | | | | | | | 9 | 10 | | | | | | |

Tables and Graphs for WD-XRF Technique

| | | |
|---------------------------------|--------------------------------|------------------|
| $K\alpha_{1,2}$ (Å) | ATOMIC NUMBER | K ABS EDGE (Å) |
| $K\alpha_1$ (Å) | L ABS EDGE (Å) | L ABS EDGE (Å) |
| $K\alpha_2$ (Å) | Symbol | M ABS EDGE (Å) |
| $K\beta_1$ (Å) | ATOMIC* WEIGHT | N ABS EDGE (Å) |
| $L\alpha_1$ (Å) | CRYSTAL STRUCTURE TYPES | O ABS EDGE (Å) |
| $K\alpha$ (Å) $2\theta^{\circ}$ | ELEMENT | P ABS EDGE (Å) |
| $K\beta$ (Å) $2\theta^{\circ}$ | ALTERNATIVE CRYSTAL | Q ABS EDGE (Å) |
| $L\alpha$ (Å) $2\theta^{\circ}$ | STRUCTURE TYPES | R ABS EDGE (Å) |

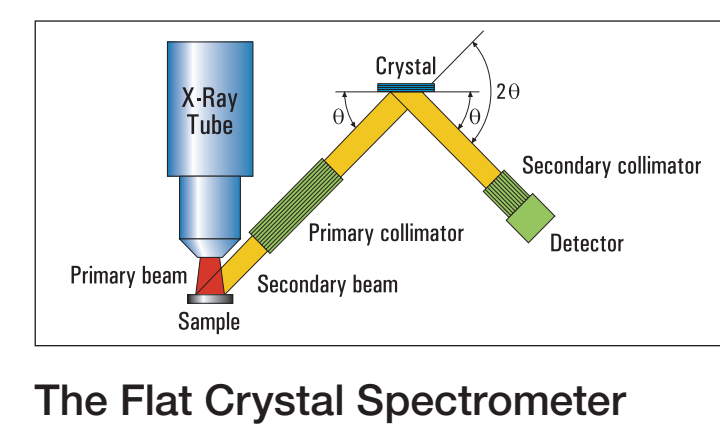
Key to Periodic Table



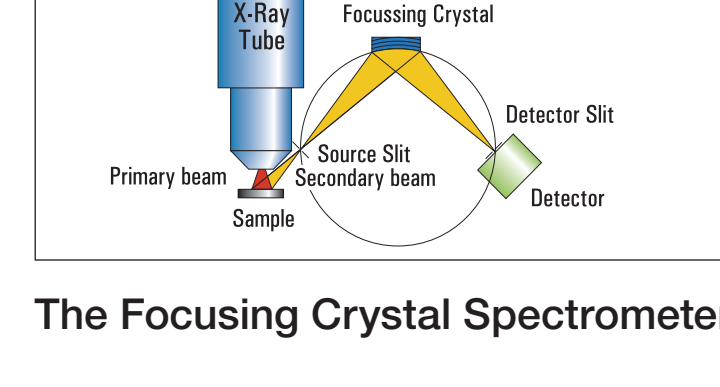
Principles of X-Ray Fluorescence

| ANALYTE LINE | GRAPHITE | GLASS | IRON | LEAD |
|--------------|----------|-------|------|------|
| U | 2800 | 1726 | 154 | 22.4 |
| Th | 2200 | 1386 | 125 | 63.9 |
| Hg | 1070 | 709 | 85.6 | 34.9 |
| W | 609 | 429 | 49.1 | 22.4 |
| Co | 1484 | 113 | 96.1 | 6.7 |
| Bi | 865 | 713 | 81.3 | 4.3 |
| Si | 595 | 418 | 50.2 | 3.3 |
| Zn | 1440 | 1097 | 70.1 | 7.3 |
| Mn | 600 | 424 | 54.9 | 2.8 |
| Ca | 4130 | 2968 | 228 | 28.9 |
| Se | 2160 | 1507 | 113 | 14.6 |
| Br | 1830 | 1183 | 108 | 5.1 |
| Al | 1773 | 1132 | 102 | 3.0 |
| Zr | 680 | 489 | 48.1 | 2.8 |
| Cr | 3512 | 260 | 38.4 | 2.0 |
| Ni | 4286 | 307 | 29.8 | 1.6 |
| Fe | 2750 | 198 | 164 | 11.1 |
| Mg | 2130 | 1507 | 31 | 9.0 |
| Cr | 1619 | 1221 | 94 | 7.23 |
| Ca | 86 | 54.33 | 6.5 | 3.01 |
| K | 355 | 40.22 | 7.2 | 3.04 |
| O | 172 | 20.91 | 4.3 | 2.19 |
| S | 116 | 14.81 | 0.1 | 4.65 |
| Si | 48.3 | 16.14 | 0.69 | 2.47 |
| Al | 213 | 15.07 | 31 | 9.01 |
| Cr | 20 | 7.08 | 1.02 | 1.13 |
| Ca | 86 | 54.33 | 6.5 | 3.01 |
| K | 355 | 40.22 | 7.2 | 3.04 |
| O | 172 | 20.91 | 4.3 | 2.19 |
| S | 116 | 14.81 | 0.1 | 4.65 |
| Si | 48.3 | 16.14 | 0.69 | 2.47 |
| Al | 213 | 15.07 | 31 | 9.01 |
| Cr | 20 | 7.08 | 1.02 | 1.13 |
| Ca | 86 | 54.33 | 6.5 | 3.01 |
| K | 355 | 40.22 | 7.2 | 3.04 |
| O | 172 | 20.91 | 4.3 | 2.19 |
| S | 116 | 14.81 | 0.1 | 4.65 |
| Si | 48.3 | 16.14 | 0.69 | 2.47 |
| Al | 213 | 15.07 | 31 | 9.01 |
| Cr | 20 | 7.08 | 1.02 | 1.13 |

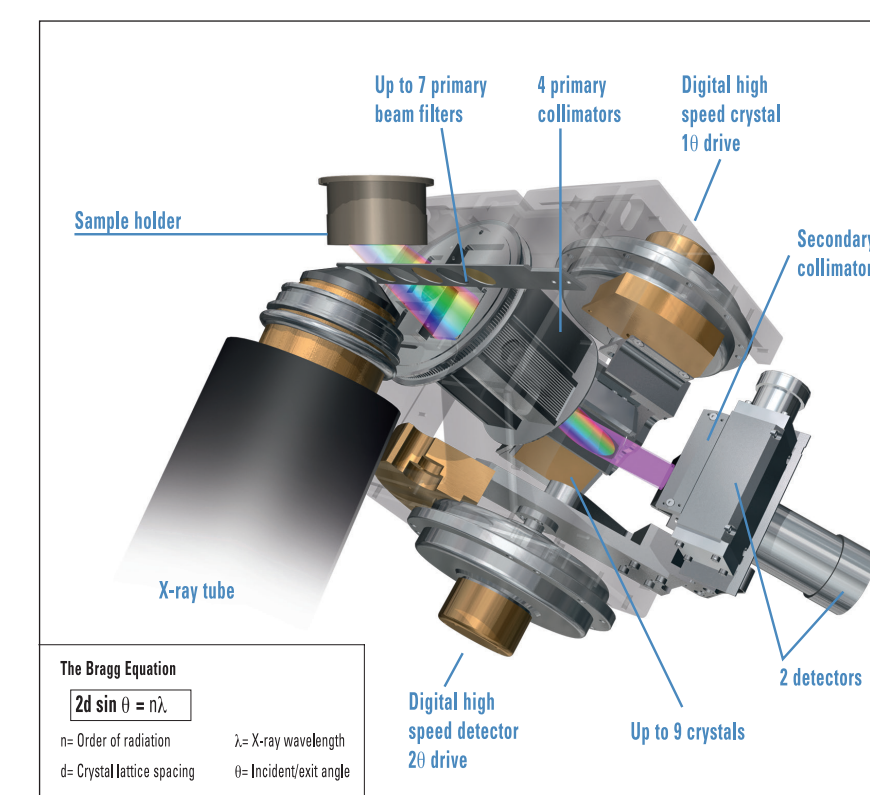
Depth of Analysis in μm (90%) $I = I_0 e^{-\mu\rho t}$



The Flat Crystal Spectrometer



The Focusing Crystal Spectrometer



Exclusive Gearless Goniometer Principle of Operation

| FEATURE | SENSITIVITY | RESOLUTION | Be | B | C | N | O | F | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Co | Zn | Sn | As | Se | Br | I | U | Am | | | | | | | | |
|---------------|-------------|------------|----|---|---|---|---|---|----|----|----|----|---|---|----|---|----|----|----|----|----|----|----|----|----|---|---|----|--|--|--|--|--|--|--|--|
| X-Coarse | High | Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X-Fine | High | Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AX16 | High | Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AX09 | Good | Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AX06 | High | Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AX03 | Good | Good | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ADP | Low | High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PET | Good | Fair | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| InSb | High | High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ge111 | Good | High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LiF 200 | Good | Good | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LiF 220 | Fair | High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LiF 400 | Low | High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DETECTOR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FPC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Scintillation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Goniometer Configuration Selection of Collimators, Crystals and Detectors