QUANTAX User School Outline

Lecture 1: X-ray Basic Physics, System Parameters and Qualitative Analysis - *(Day 1)*

I. System Description
- *A. Components*
  - *1. Spectrometer*
  - *2. Electronics*
  - *3. Analyzer hardware*
- *B. Spectrometer resolution*
- *C. Spectrometer efficiency*

II. Data Collection
- *A. Energy calibration*
- *B. Count rate considerations*
  - *1. Statistics*
  - *2. (3 Sigma Rule)*

III. X-ray Physics
- *A. Generation of x-rays*
  - *1. Characteristics of x-rays*
  - *2. Continuum*
  - *3. Artifact peaks*
- *B. Moseley's Law*
- *C. Beer's Law*

IV. Microscope/Detector Parameters
- *A. Sample/Detector geometry*
- *B. Probe current*
- *C. X-ray range (volume)*

V. Qualitative Analysis
- *A. Parameters*
  - *1. Accelerating voltage*
  - *2. Sample/Detector geometry*
  - *3. Probe current/Count rate*
- *B. Identification*
- *C. Dealing with overlaps*

Laboratory 1: X-ray Basic operation and Qualitative Analysis

I. Overview of System
- *A. Detector*
  - *1. Components*
  - *2. Filling Dewar*
  - *3. LN_2 monitor*
  - *4. Bias control*
  - *5. Variable X*
  - *6. Variable Y*
- *B. Analyzer*
  - *1. Components*
  - *2. Software*
    - *a. Version*
    - *b. Booting system*
  - *3. Display*
  - *4. Mouse/Keyboard operation*
- *C. Calibration*
- *D. General X-ray data collection*

II. Qualitative analysis and general operation
- *A. Display spectra*
- *B. Spectra control*

C. Identification
   1. Manual
   2. Computer-assisted
   3. Automatic
   4. Escape/sum

D. Checking detector efficiency
E. Handling overlaps
   1. Recognizing overlaps
   2. Comparing spectra
   3. Using background subtraction
   4. Relative ratios

Lecture 2: Comparative Analysis - *(Day 2)*

I. Comparative Analysis
   A. Relative ratio/Match/Fingerprint Analysis
   B. K-ratio
   C. Concentration curve
   D. Graphic techniques
      1. Analog dot mapping and line profiles
      2. Digital mapping and line profiles
      3. Position tagged spectrometry (PTS / HyperMap)

II. General X-ray Techniques
   A. Ideal sample
   B. Sample charging
   C. Rough surface/powder
   D. Multi-phase
   E. Thin films
   F. Foils
   G. Particles on substrate

Laboratory 2: Mapping, Line scan and Comparative Techniques

I. Collection of SpotLight / Multi-point, X-ray maps, line profiles, PTS / HyperMap. Review of ID and overlaps

II. Comparative Analysis
   A. Relative ratio/Match Analysis
   B. K-ratio
   C. Subtracting substrates

Lecture 3: Quantitative Analysis - *(Day 3)*

I. Theory
II. Background subtraction
III. K-ratio/Deconvolution
IV. Matrix correction
V. Standards versus standardless
VI. Microscope parameters
   A. Accelerating voltage
   B. Sample/Detector geometry
   C. Count rate
   D. Probe current

V11. Description of Bruker Quantitative Programs

Laboratory 3: Quantitative Analysis

I. Setting up quant
- *A. Take-off angle*
- *B. Efficiency*

II. Standardless Analysis
III. Partial standards analysis
III. Full standards analysis
IV. Rough surface/powder
V. Thin section (Cliff-Lorimar)
VI. Hall
VII. Output

Lecture 4: Digital Image; Analysis and Processing - *(Day 3)*

I. Terminology
II. What is digital imaging?
III. Sources
IV. Calibration
V. Image Processing
- *A. Transforms*
- *B. Filters*
  - *1. Arithmetic*
  - *2. Logic*
- *H. Binary*
- *C. Math operations*
- *D. Artificial intelligence programs*
- *E. Cross fibers*

VI. Image Analysis
- *A. Area fraction*
- *B. Point to point*
- *C. Feature*
- *D. Critical dimension*
- *E. Coatings thickness*
- *F. Stereo depth measurements*

Laboratory 4: Digital Imaging – *(Day 4)*

I. Optimize image collection
II. Basic display operations
III. Advanced operations

At the end of each day: (Optional: open lab and review)