



X-ray Fluorescence Analysis & Application

ISP Co., Ltd

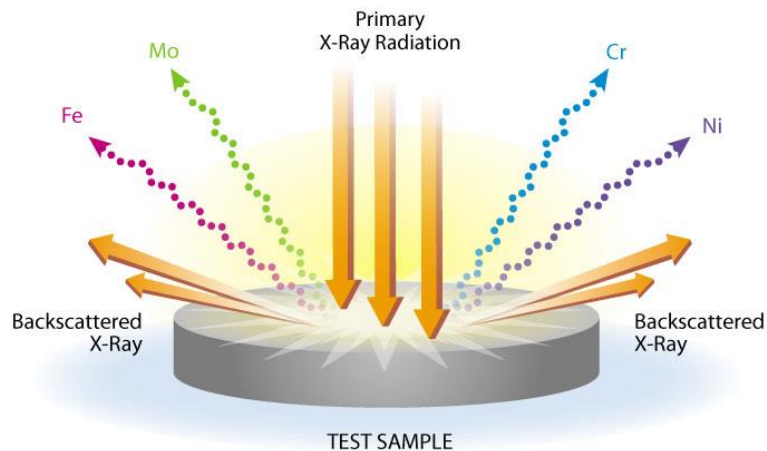
Contents

- ◆ XRF & Components
- ◆ Spectrum Analysis
- ◆ Quantification
- ◆ In-Line Application
- ◆ About ISP

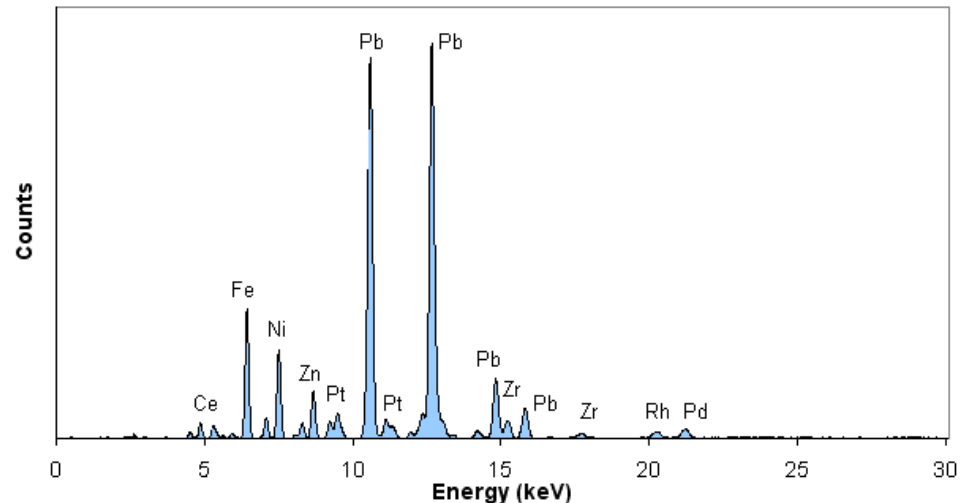
XRF & Component

What is XRF ?

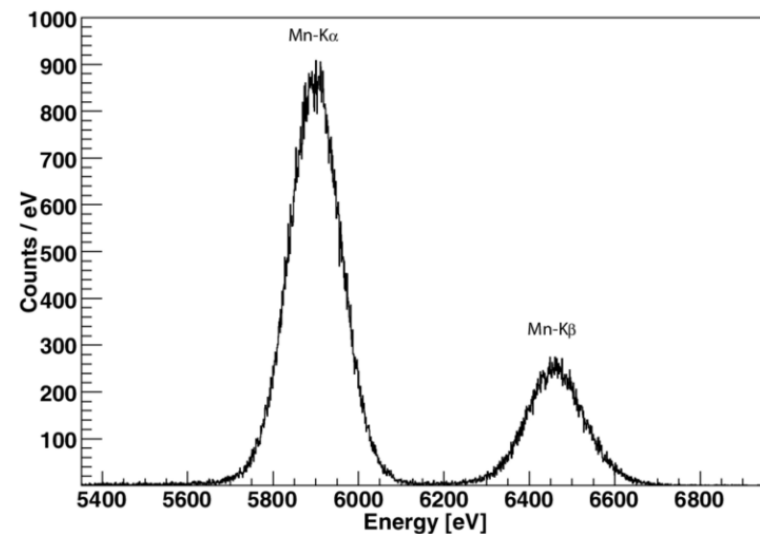
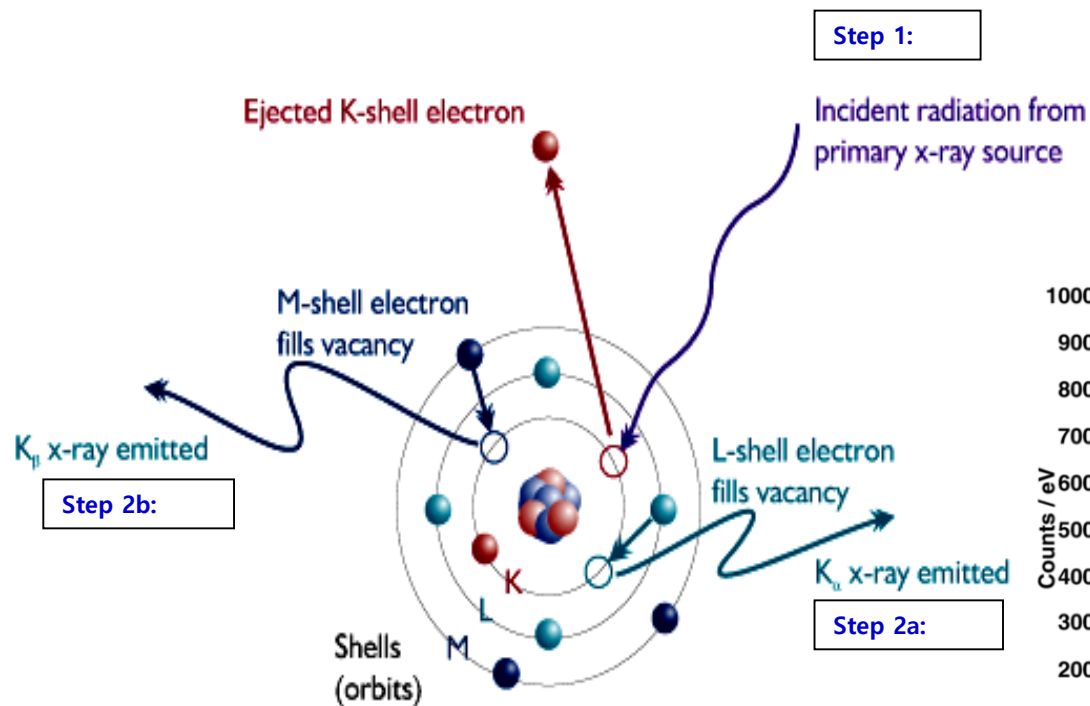
- ❖ XRF(X-ray Fluorescence Spectroscopy)
 - Emission of characteristic fluorescence
 - >> Qualitative and Quantitative analysis



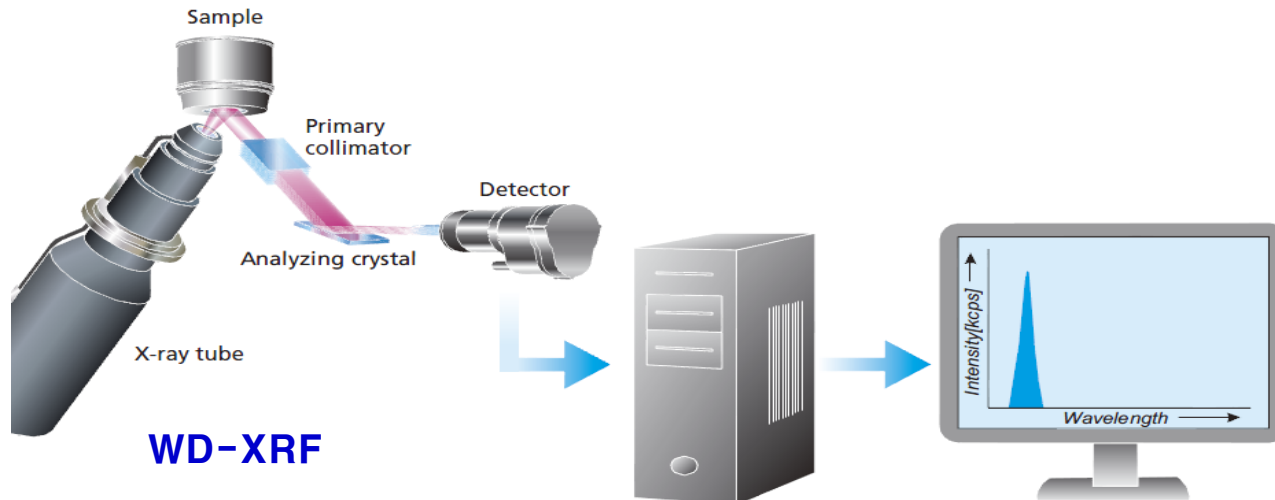
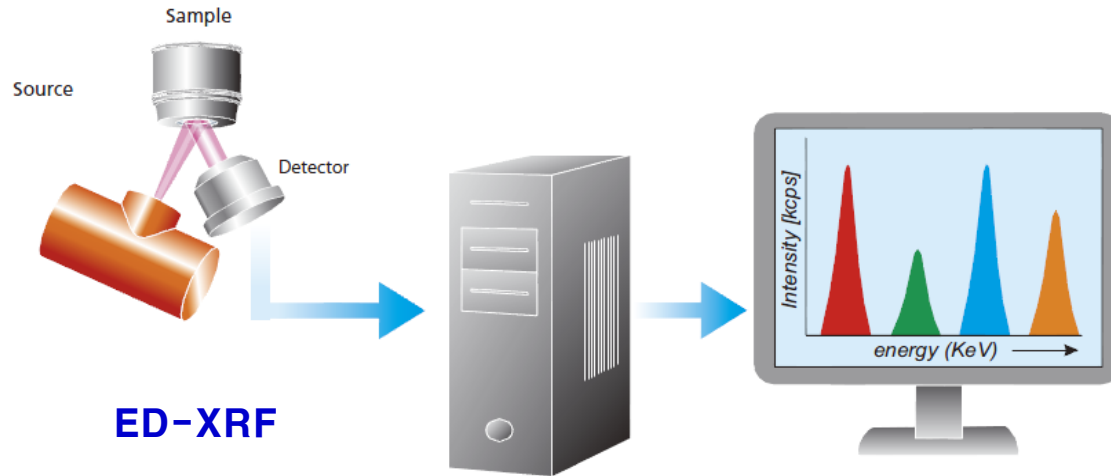
Supper SDD: 25 mm²/500 μm Silicon Drift Detector
Automotive Catalyst



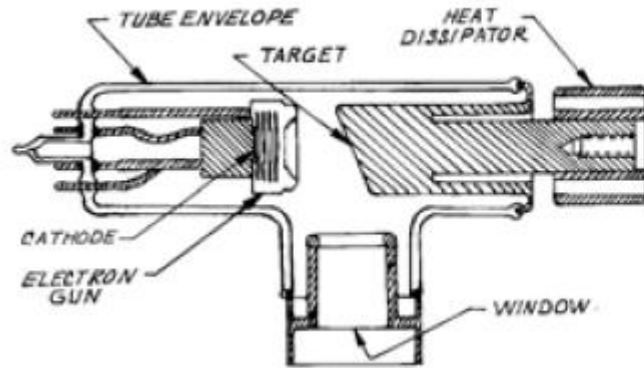
X-ray Fluorescence Generation



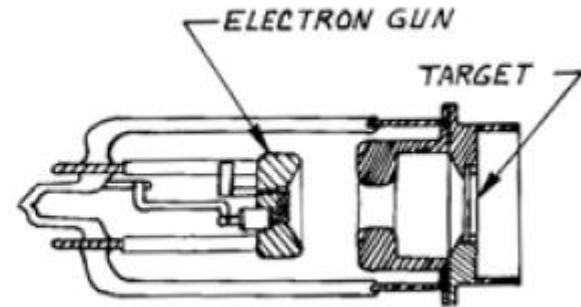
Kind of XRF



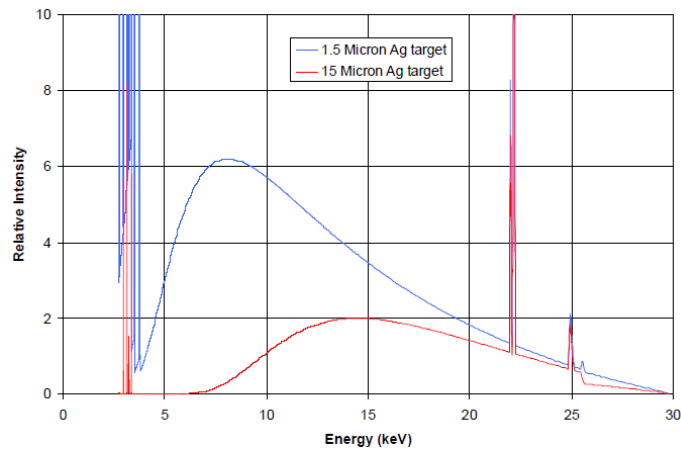
Key Component : X-ray Tube



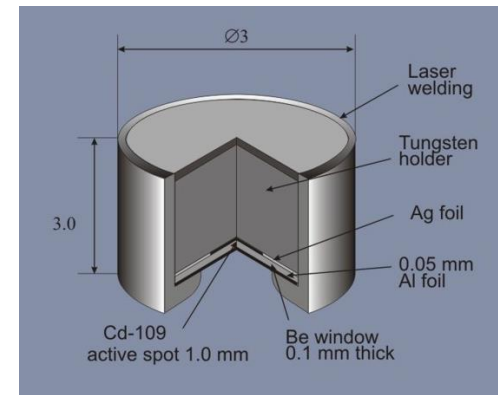
Side Window



Transmission

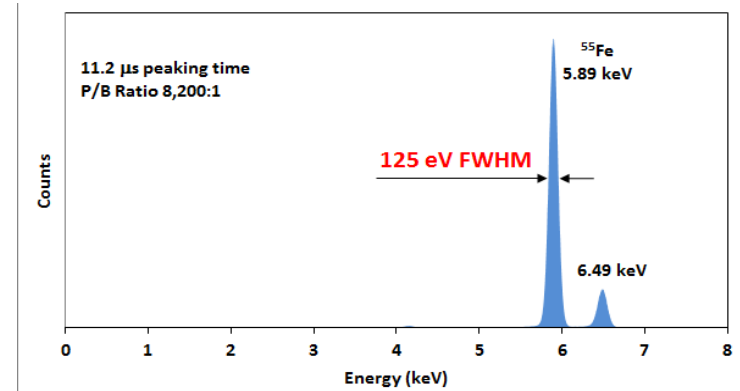


Spectrum



Radioisotope

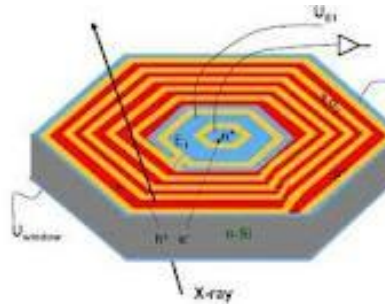
Key Component : X-ray Detector



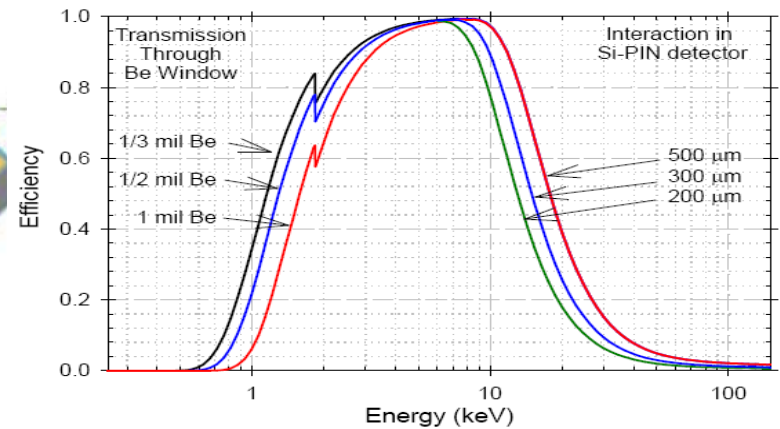
Energy Resolution



Packing



SDD 구조

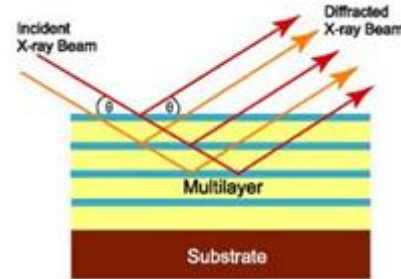


Window & Cell 두께

자료출처 : Amptek, PN Detector

Key Component : X-ray Optics

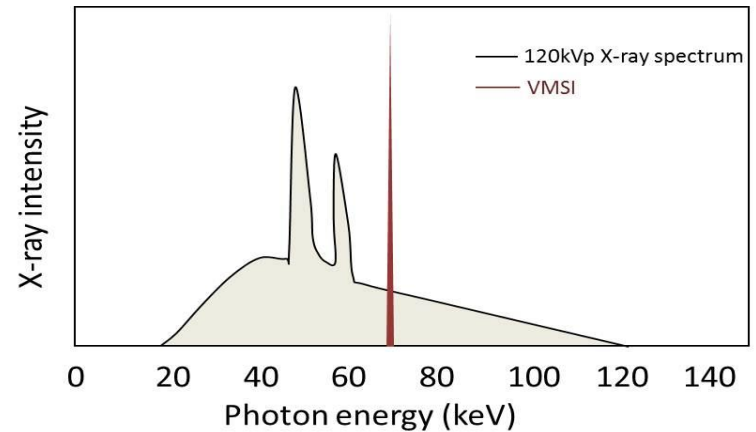
**Monochromatic
X-ray
Excitation**



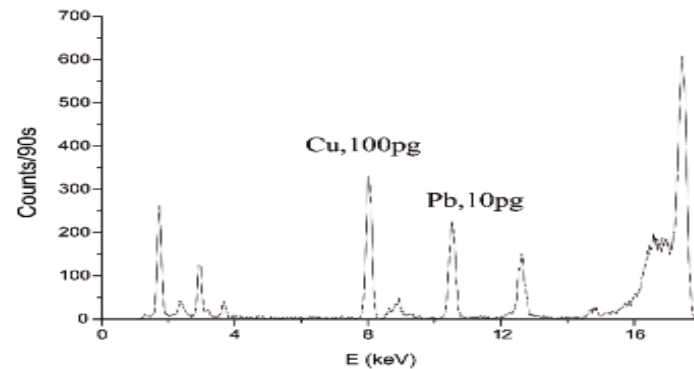
Multi-Layer



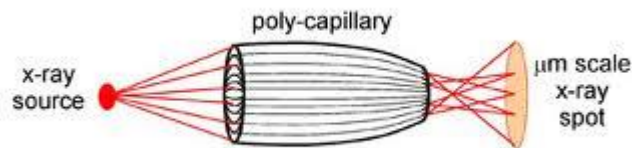
Crystal DCC



Mo Ka Beam, Pb (20ppb) and Cu(200ppb)



**High Gain at
Focal Point**



Capillary Optics

자료출처 : XOS

Advantage and Dis-Advantage of XRF Analysis

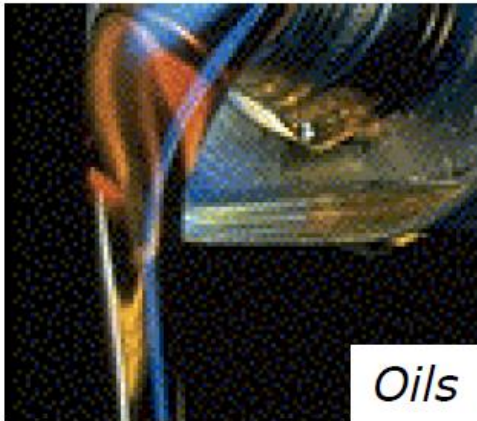
Advantage

- 비 파괴 검사
- 시료 전처리 최소화
- 넓은 측정범위 (수 ppm ~ 100wt%)
- 간편한 사용법(측정자의 숙련도에 의존하지 않음)
- 동시 다 원소 분석

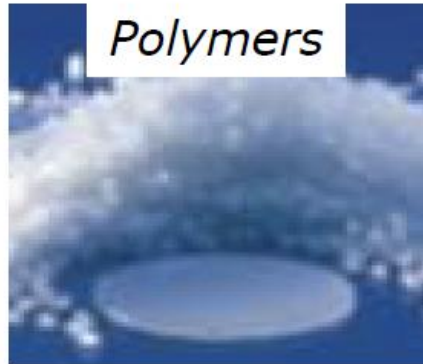
Dis Advantage

- 검량선 작성을 위한 표준시편 필요
- 경원소 분석의 한계
- 표면 및 공존원소 상호 간섭에 따른 오차

XRF Application



Oils



Polymers



Ores and raw materials



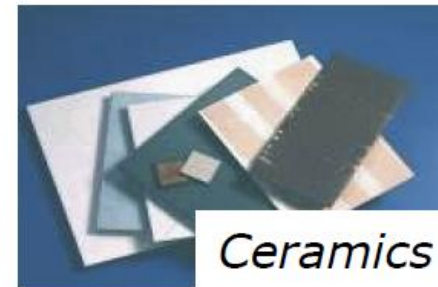
Chemicals



Glass



Metals, Slags



Ceramics

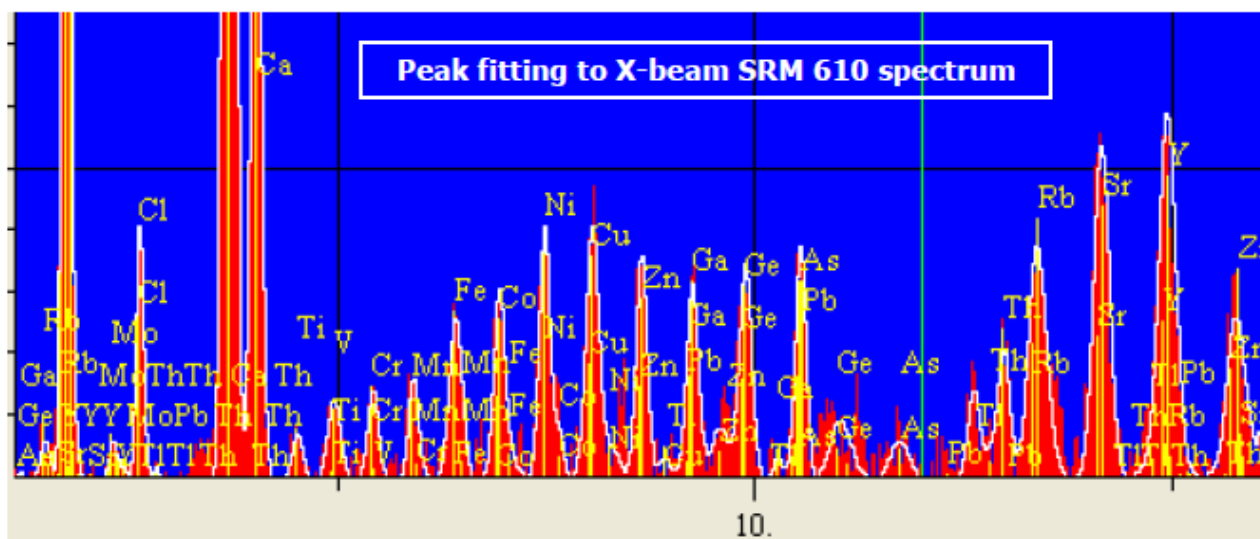
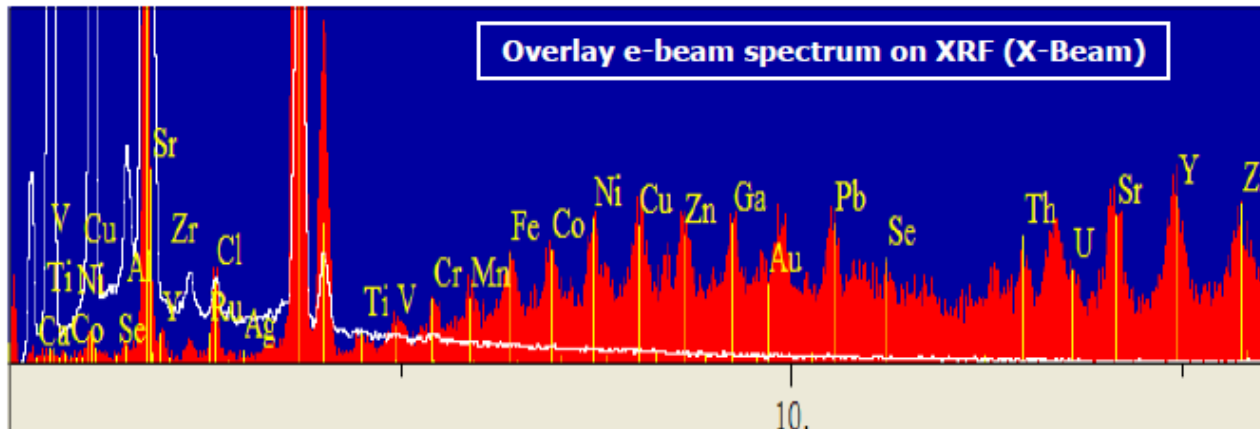


Food products
ISP Co., Ltd

Spectrum Analysis

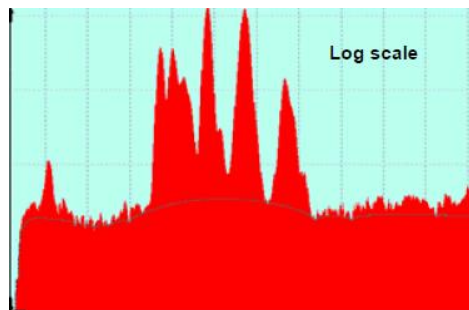
What is XRF Spectrum

NIST SRM 610	
Component	Wt%
SiO ₂	72.00
CaO	14.00
NaO ₃	14.00
Al ₂ O ₃	2.00
ppm	
Co	390
Cu	444
Fe	458
Mn	485
Ni	458
Ag	254
Sr	515
Th	457
Ti	437
Pb	426
K	461
Ru	425
Th	61
U	461
Zn	433

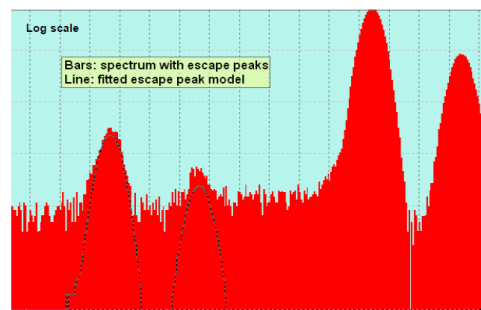


Consideration of Spectrum Processing

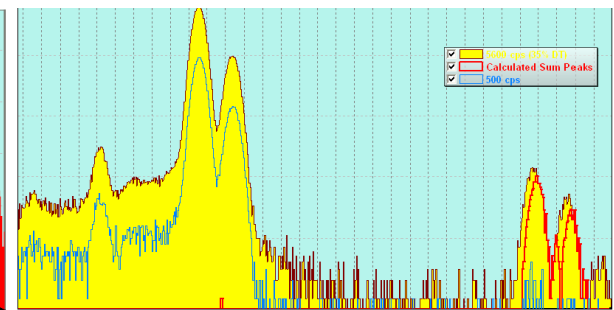
- Artifact Peaks
 - Escape peaks, Sum (Pile-Up) peaks
 - Detector/window absorption/fluorescence
- Background removal



Background



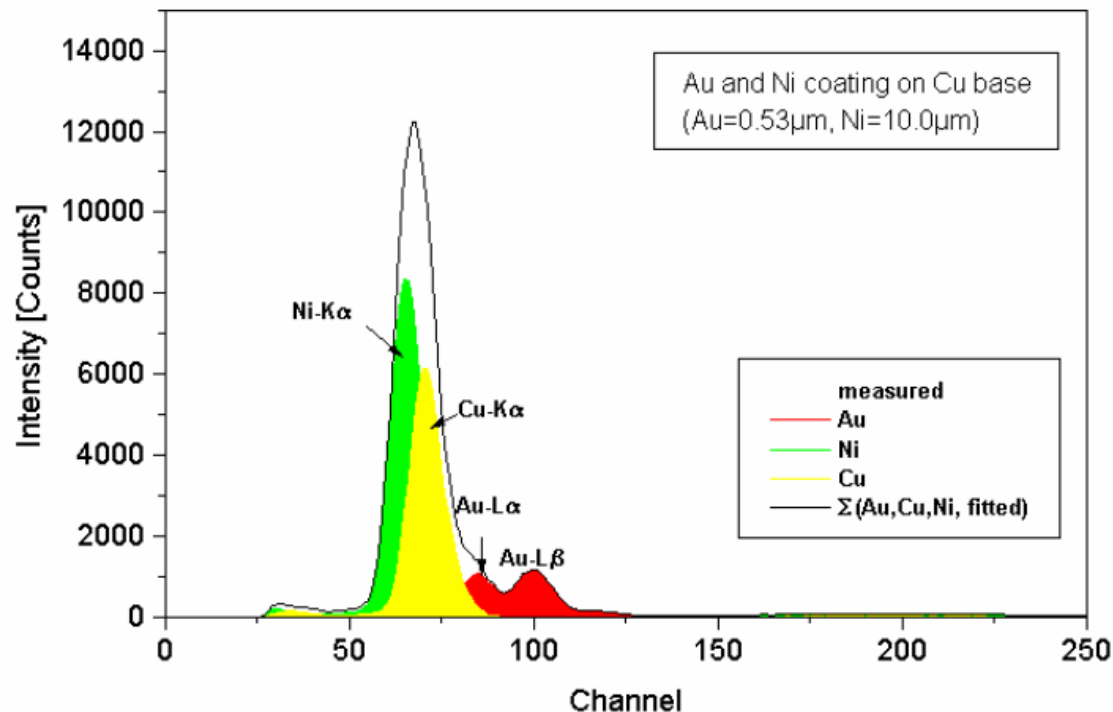
Escape Peak



Sum Peak

Consideration of Spectrum Processing

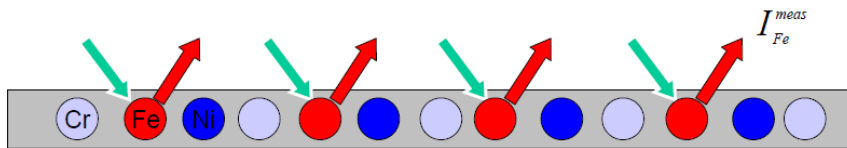
- Spectrum de-convolution (peak fitting)
 - Simple integration – w/ or w/o overlap
 - Theoretical vs. Reference peak models



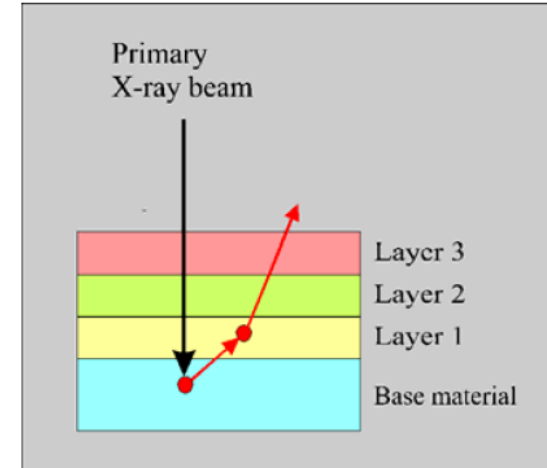
Quantification

Model

Bulk



Layer



- Polymer & Organic
 - Calibration Curve
- Metal
 - Fundamental Parameter

- Calibration Curve
 - Fundamental Parameter

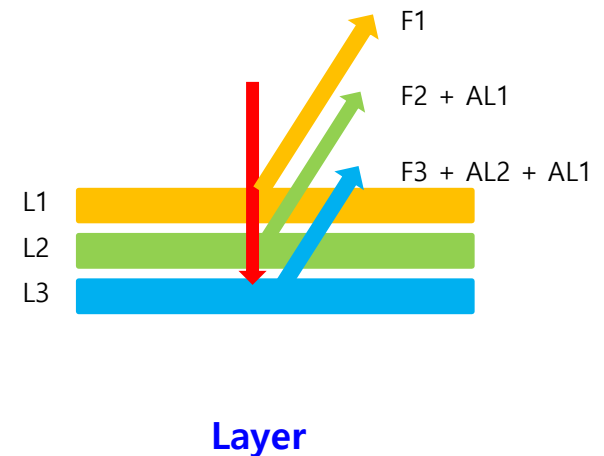
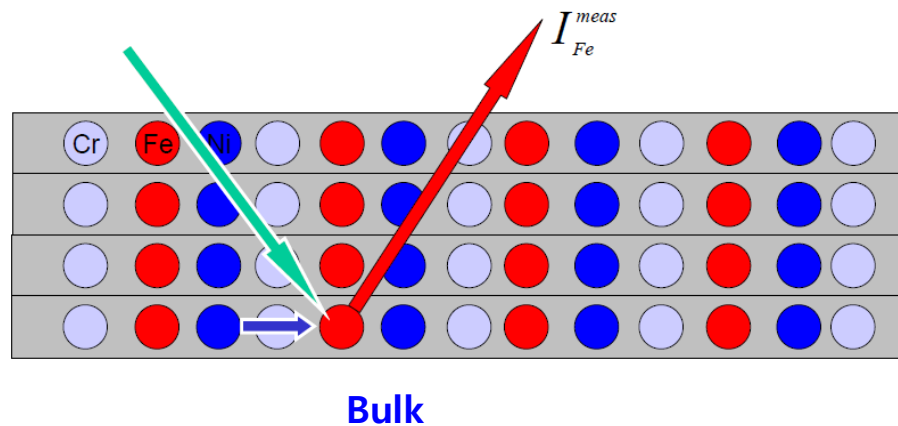
Consideration of Quantification

- Matrix Effect(Absorption & Enhance)

Self-absorption (linear for thin layer case)

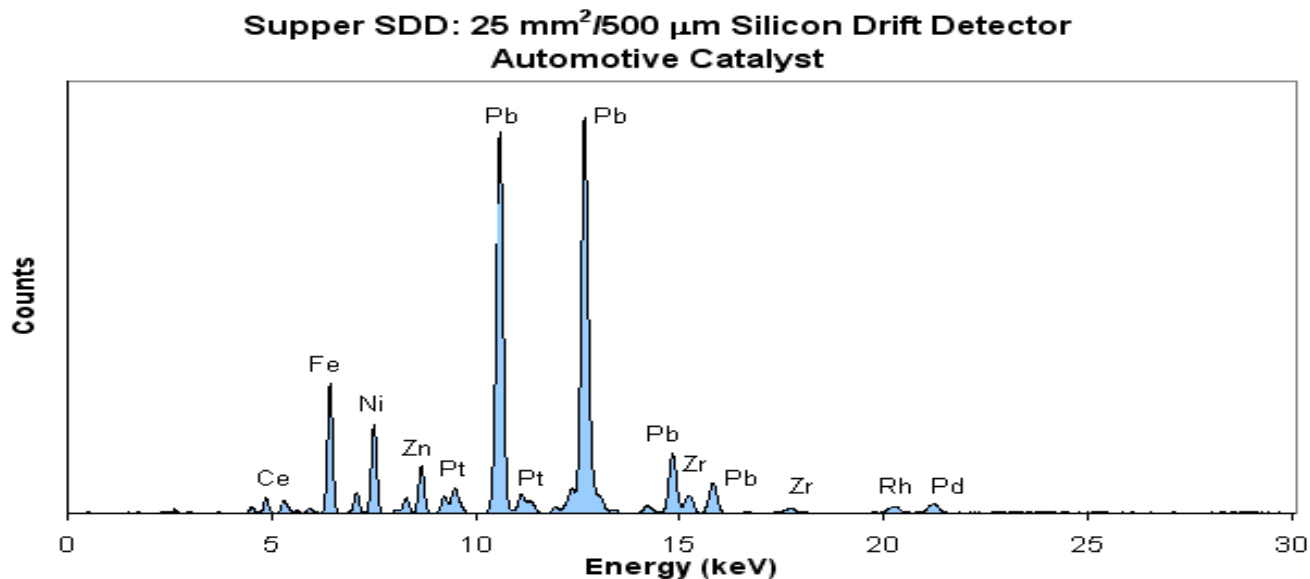
Layer absorption (has also to be considered for thin layers case)

Enhancement (negligible for thin layer case)



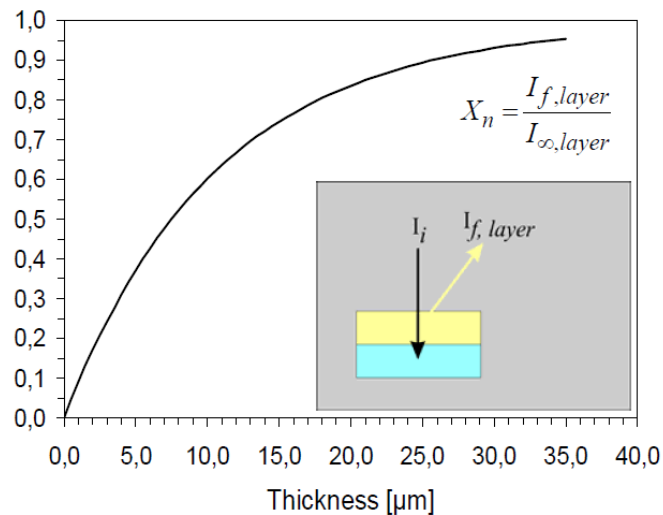
Consideration of Quantification(Bulk)

- Normalize 100% for observed Fluorescence peak
 - X-source Excitation condition(need reference model)
 - Geometry(Incident Angle, Scatter Angel, Solid Angle, Filter. .)
 - Detector Parameter(Window, Thickness(Efficiency, layer...),

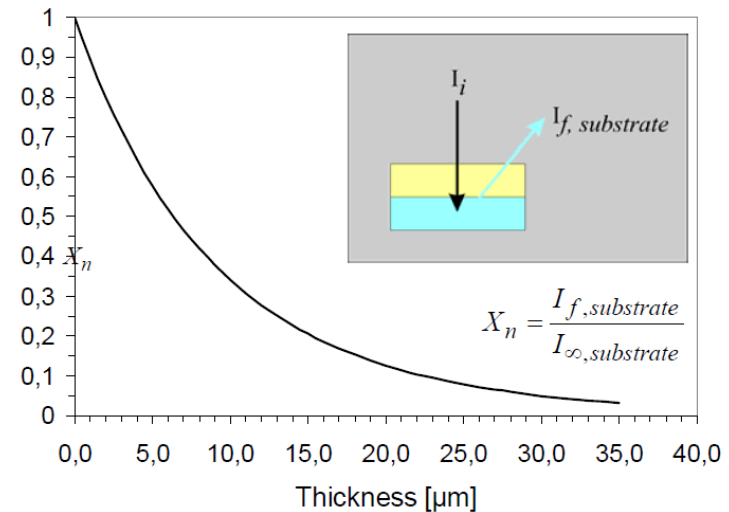


Consideration of Quantification(Single Layer)

- Fluorescence mode Calibration
- Absorption mode Calibration



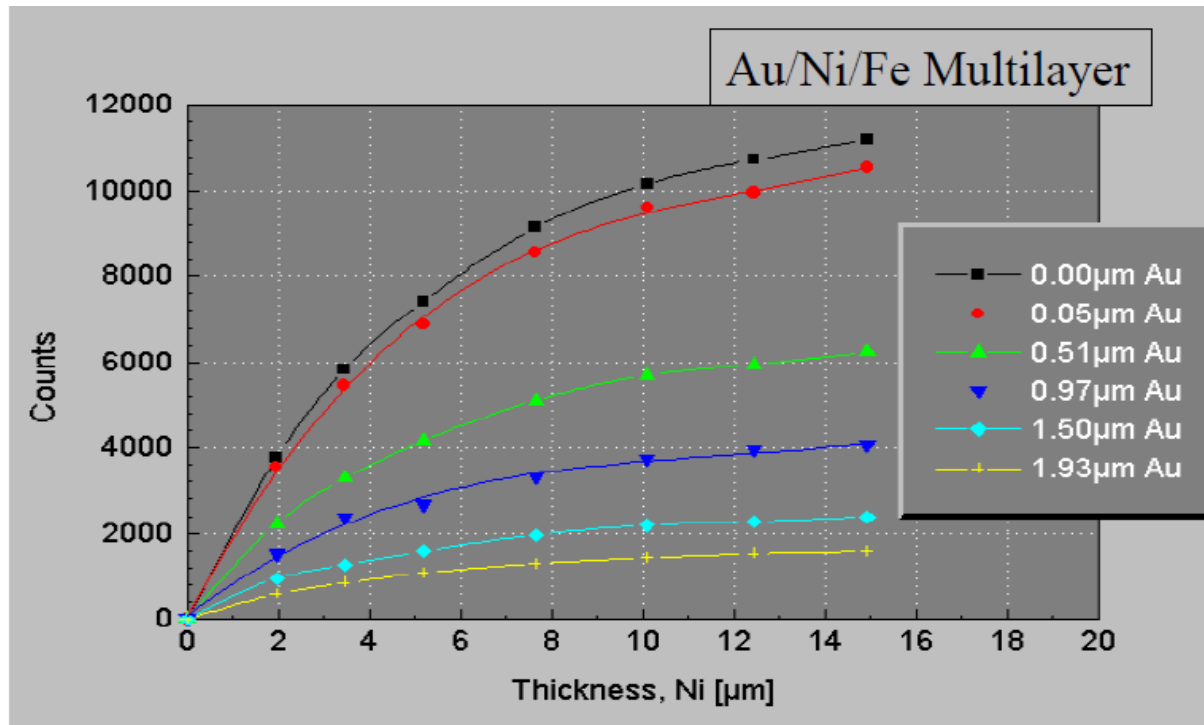
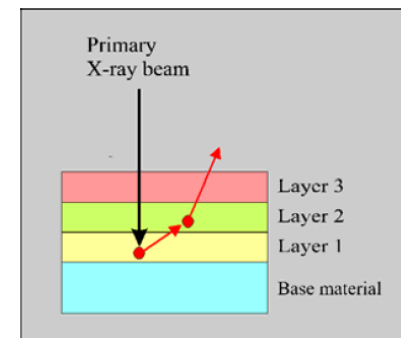
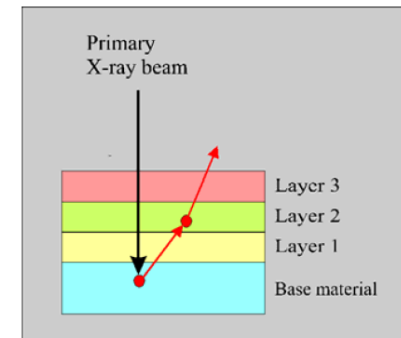
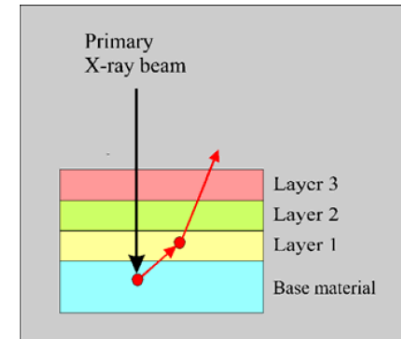
Fluorescence



Absorption

Consideration of Quantification(Multi Layer)

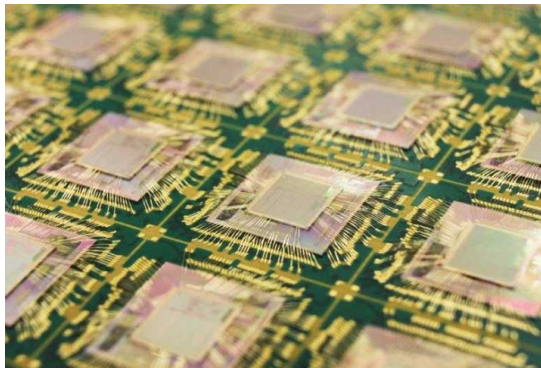
- Top Layer have to Calibrated
 - Consider Absorption and Enhance
 - Layer Composition(Multi Element),



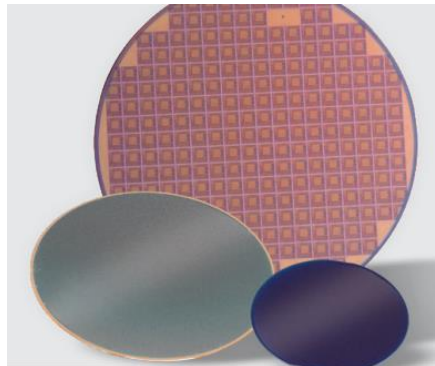
In-Line Application

Key Issue for In-Line XRF

- **Short Measuring Time**
- **Full Automation of Sample Handling**
- **Automatic Alignment**
- **Recipe based Measurement**
- **MES/LMS Interface**
- **Process Control with Production Line**



ENIG/ENEPIG PCB



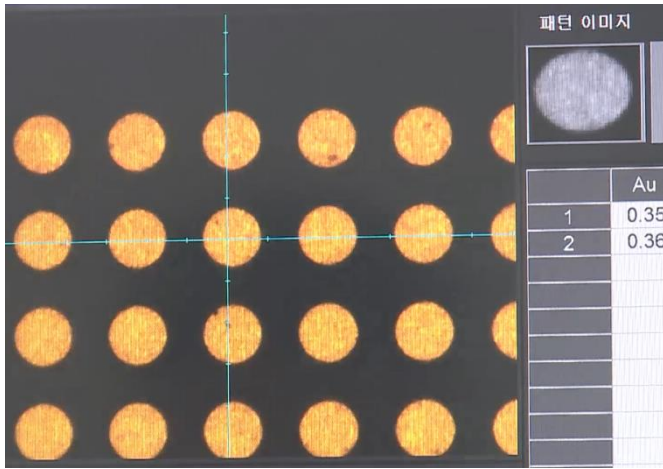
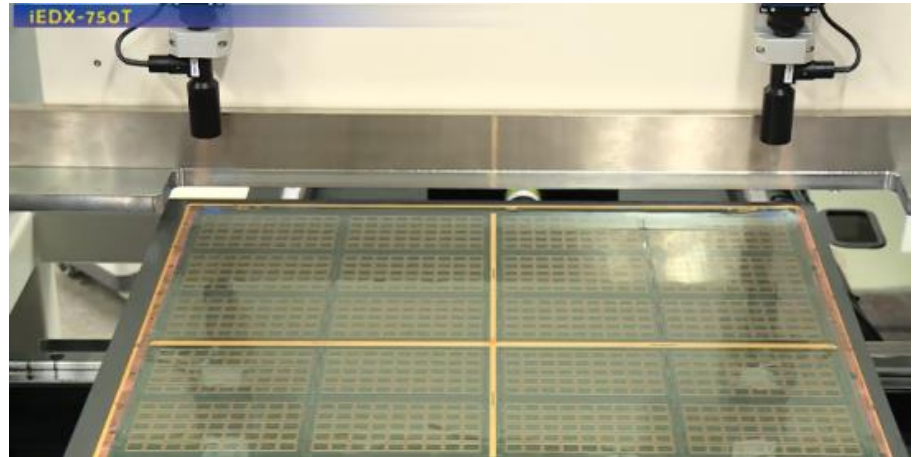
Semiconductor



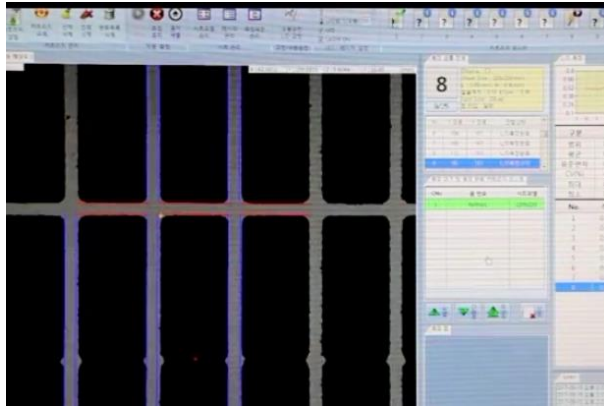
Solution

PCB Application

- < 5 Sec / Point
- Max Loading 800 x 600
- Box Loading
- Auto Mated Sample Handling
- MES Interfaced



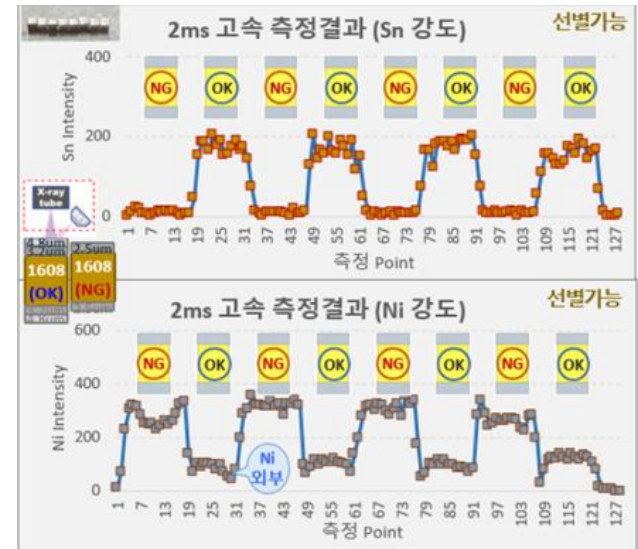
MLCC



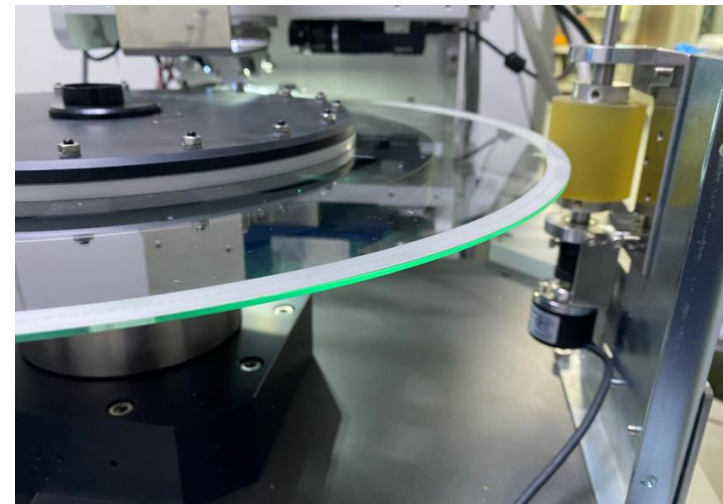
Inner Electrode



Gravure In-Line



2mS Measuring Time Validation



미도금 In-Line

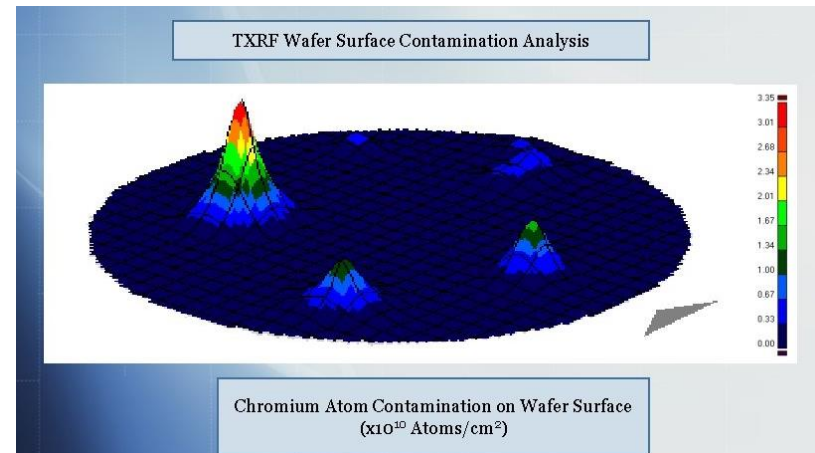
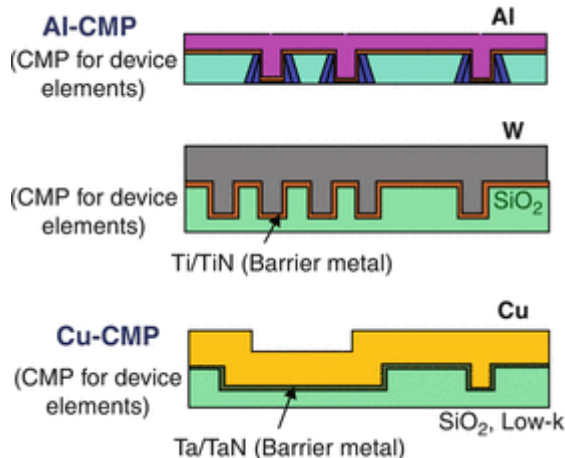
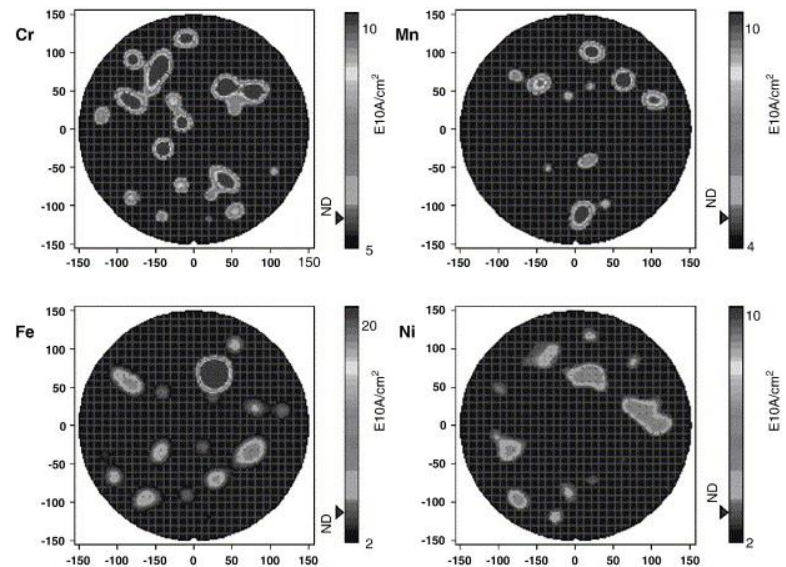
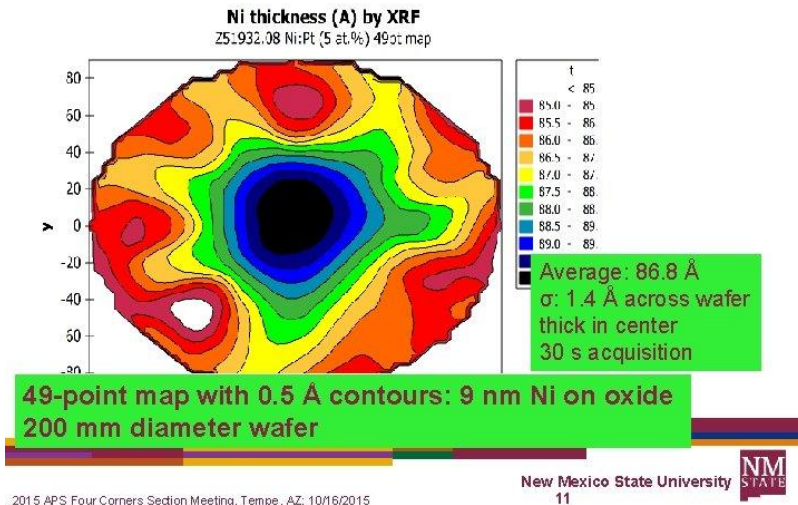
XRF Analysis & Application

Liquid Solution In-Line



Semiconductor

XRF application: 49-point wafer map



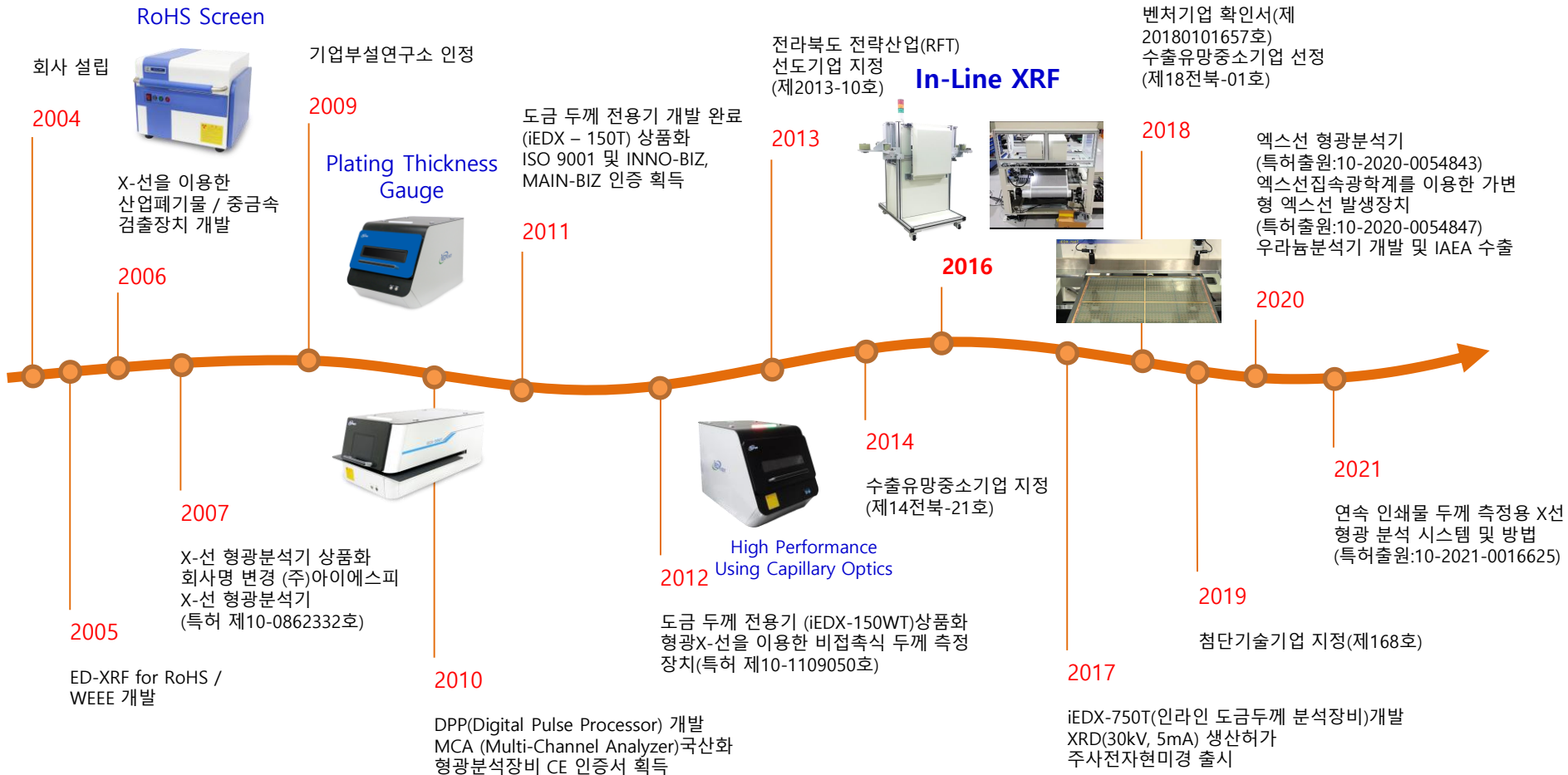
About ISP

ISP is

Leading Table Top and In-Line XRF Application

Innovative
Solution
Provider

History



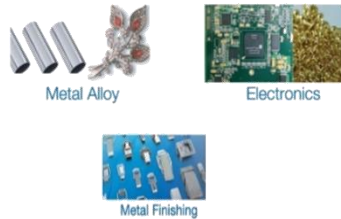
사업분야

유해물질분석기



- RoHS에 대응하기 위해 Cl, Br, Pb, Cd, Cr, Br, Hg 등 유해 중금속 screening장비(<1,000ppm)
- 엔진오일 내 Fe 150ppm< 함유여부 확인
- 리드탭 Cr 100, 150, 200ppm확인 가능

도금두께측정기



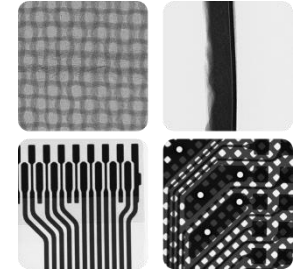
- Au, Ni, Pd, Ag, Cr, Sn등 도금두께측정장비 (0.01~30um)
- ENEPIG, ENIG, 반도체 등
- 동도금측정기(0.1~120um : PCB)

품질/공정관리 자동화



- 선별검사 → 전수검사
- 품질관리 → 공정관리
- 인적판단 → AI 관리 (DB, MES)

엑스선 영상분석장비



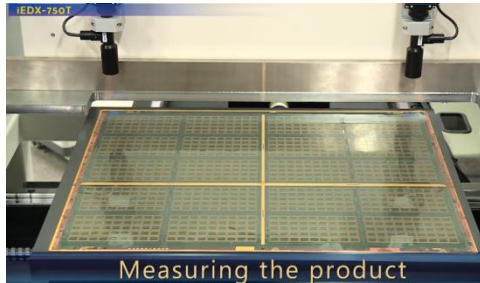
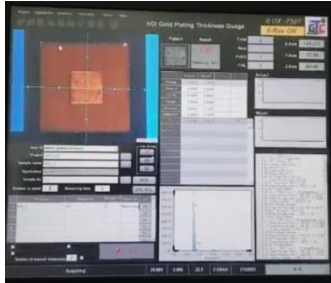
- 생명과학, 재료과학, 실험실 동물 촬영 등 분석에 최적화된 고해상도 영상
- 편의성 및 확장성이 고려된 샘플 로딩 시스템
- 샘플 분석에 최적화된 소프트웨어 제공

- ED-XRF (X-선 형광분석기)
- X-선 형광 도금두께 측정기
- 동(Cu) 도금두께측정기
- 소형 정밀부품 및 바이오센서 2D/3D 영상분석장비
- 인라인 도금두께 분석장비



In-Line Application

◆ PCB In-Line



◆ Cu-Line



◆ Wafer In-Line



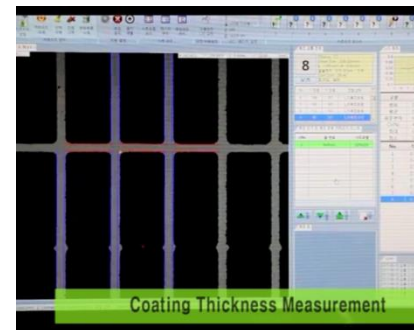
◆ Reel to Reel



◆ Roll to Roll



◆ MLCC



Discussion

◆개발 및 협력 방안 모색

- ✓ 핵심소자 국산화
- ✓ 반도체 Application
- ✓ BIO Application

