



新機介紹: X 光能量分散光譜儀

型號: QUANTAX ANNULAR XFLASH<sup>®</sup>

QUAD FQ5060

功能簡介: 微區顯微成分之定性及半定量

分析(Spectrum Quantification)、多點分析

(Objection Quantification), 線分析(Line Scan)

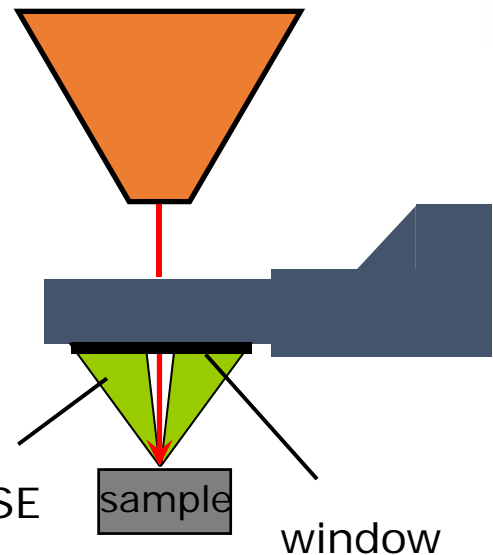
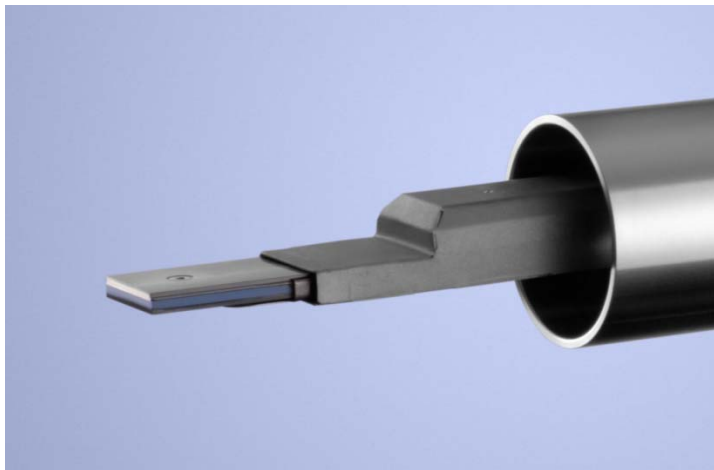
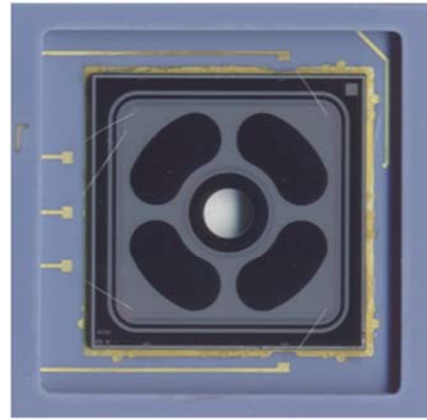
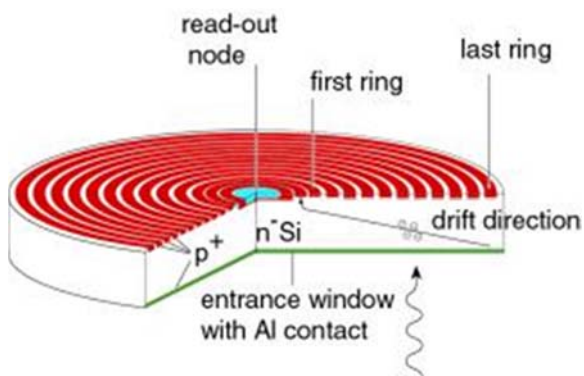
及面元素分佈分析 (Mapping)



# 儀器規格 XFlash<sup>®</sup> 5060FQ

- ◆ **Active area(訊號接收面積) : 60 mm<sup>2</sup> (4 x 15 mm<sup>2</sup>)**
- ◆ **Detection element(偵測元素範圍) : Boron (z=5) to Americium (z=95)**
- ◆ **Energy resolution(能量解析度) : ≤133 eV (MnK  $\alpha$ , 100 000 cps)**
- ◆ **Maximum input count rate(最大訊號接收量) : > 2 million cps**
- ◆ **Cooling(冷卻方式) : Peltier cooled**
- ◆ **Quantification Software 定量軟體—ESPRIT 2.0 版**
  - ◆ ESPRIT Quant : Automatic software tools for standard less quantitative spectra analysis
  - ◆ ESPRIT EQuant : Extended spectra analysis for expert users
  - ◆ ESPRIT UQuant : Editor for user defined spectra methods
  - ◆ ESPRIT HSQuant : Combination of standard based quantification and standard less quantification
  - ◆ ESPRIT SpecMatch : spectrum matching of similar spectra
- ◆ **Objection, Line Scan and Mapping 多點/區分析, 線分析及面元素分佈分析**
  - ◆ SPRIT MultiPoint : Automatic multipoint and object analysis
  - ◆ ESPRIT Line : Ultra-fast spectral line scan
  - ◆ ESPRIT QLine : Quantitative evaluation of line scan spectra database
  - ◆ ESPRIT Map : Ultra-fast digital element mapping
  - ◆ ESPRIT QMap : Quantitative element mapping
  - ◆ ESPRIT HyperMap : Element mapping with hyper spectral database
  - ◆ ESPRIT TChart : histograms, binary and ternary charts

## 偵測器種類: Silicon Drift Detectors (SDDs)

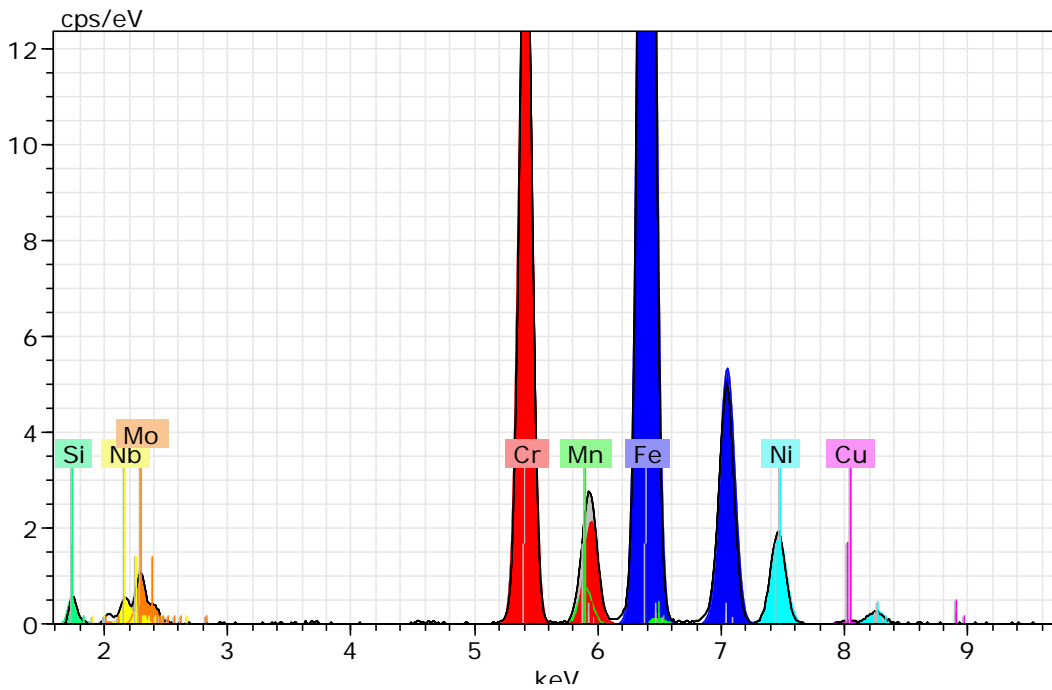


- Detector is equipped with a polymer window
- Influence of BSE needs special treatment in this geometry
- Electron trap cannot be used
- Depending on acceleration voltage BSE can affect the quality of the spectrum
- Thick polymer or Be window will block high energy BSE, e.g. HV=20kV, but will reduce low energy X-ray detection
- Thin polymer window: will enhance low energy efficiency but will only block BSE up to a certain HV

- Detector combines high count rate capabilities with high collection efficiency (solid angle)
- Application fields are:
  - (1) Particles or structures in nanometer range (low kV, smaller excitation volume)
  - (2) Beam sensitive samples (low probe current)
  - (3) Samples with high topography (avoids shadowing effects)
  - (4) Light element samples (low kV for ideal ionization cross-section)
  - (5) Thin (electron transparent) sample e.g. TEM/STEM samples (low x-ray yield)
  - (6) Ultra fast spectral mapping
  - (7) Large area mapping: mapping of neighboring areas and stitch maps together



## Quantification (Steel standard)



El	AN	Series	Net norm.	C	Error (2 Sigma)
			[wt.%]		[wt.%]
Si	14	K-series	18781	0.34	0.08
Cr	24	K-series	819876	15.59	0.88
Mn	25	K-series	41319	1.09	0.11
Fe	26	K-series	2192322	75.22	4.14
Ni	28	K-series	113772	6.20	0.40
Cu	29	K-series	2320	0.17	0.06
Nb	41	L-series	26434	0.54	0.09
Mo	42	L-series	45044	0.86	0.11

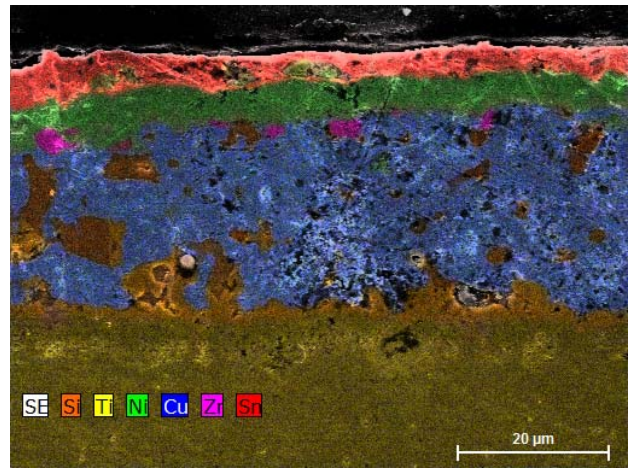
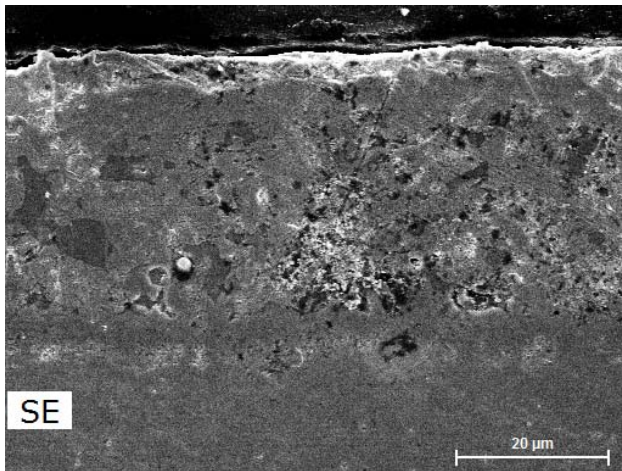
Table 1 Quantification results

C	Si	S	P	Mn	Ni	Cr	Mo	Cu	Co	Nb
0.22	0.32	0.057	0.022	1.40	6.41	15.92	0.80	0.16	0.04	0.57

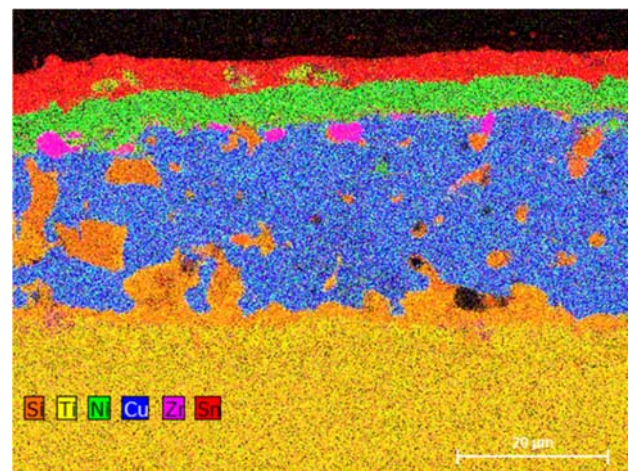
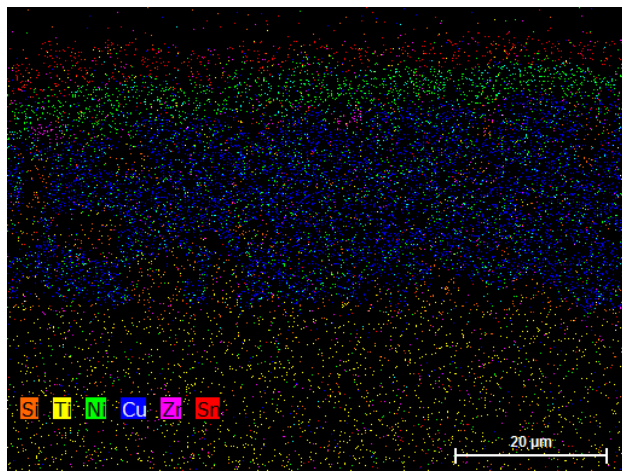
Table 2 Certified results. Please note that C, S, P, and Co are below detection limit of EDS



# 様品實作



Multilayer ceramic capacitor (MLCC): Layered structure of Si, Ti, Ni, Cu, Zr, Sn, Ba.



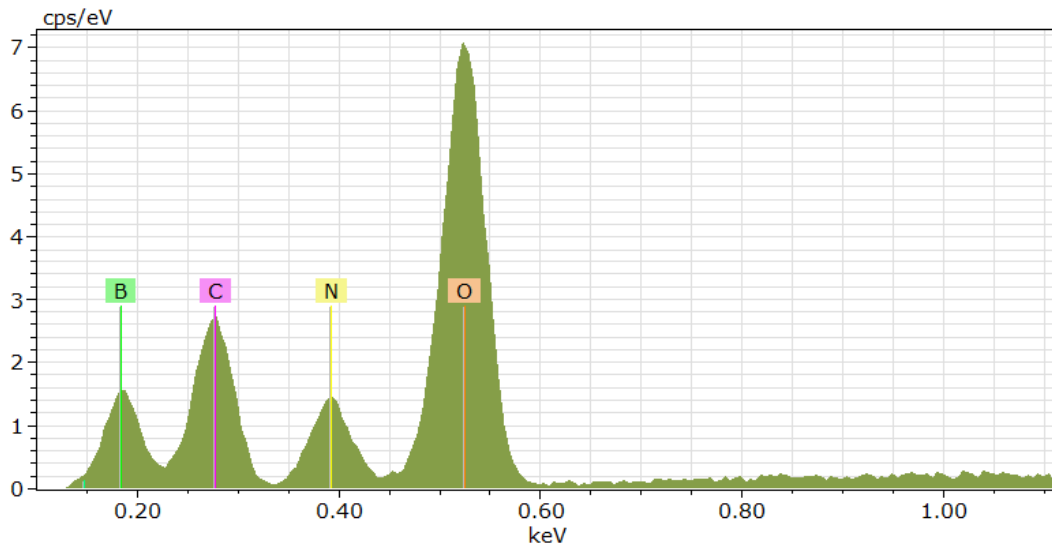
Conventional detector,  $\Omega \approx 0.01\text{sr}$   
512x384pixels, HV=10kV, 170s,  
260cps ICR, 41000 cts total

> 100x

XFlash<sup>®</sup> 5060FQ

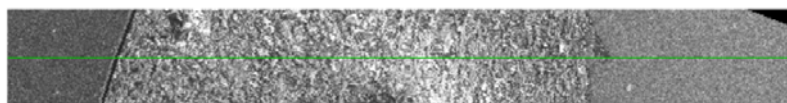
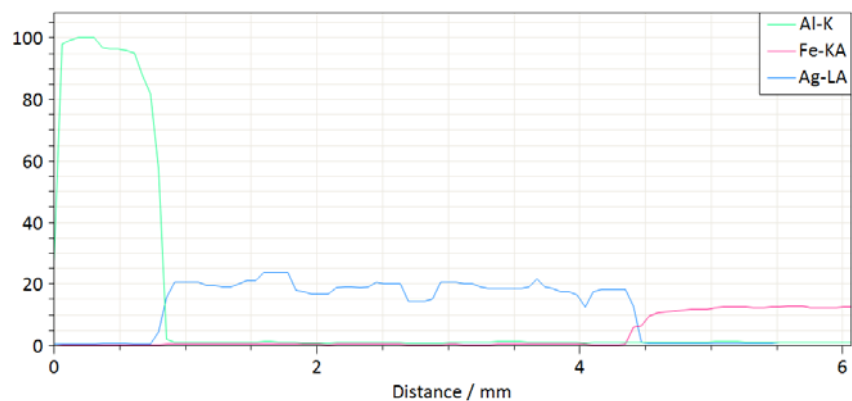
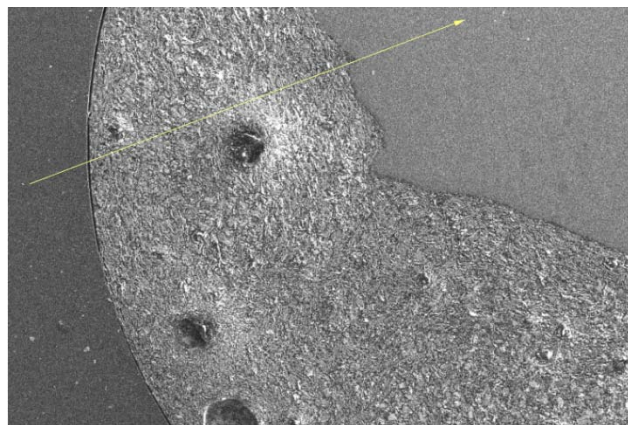
512x384pixels, HV=10kV, 170s,  
28kcps ICR, 4800000 cts total  
(same beam current)  
→  $\Omega \approx 1\text{sr}$

## Light element detection (BN)



Spectrum of BN

## Software Functions (Line scan)



Linescan results. From top to bottom are SEM graphs, line profiles, and magnified linescan region.

## XFlash<sup>®</sup> 5060FQ 收費標準

- ◆ **微區顯微成分之定性及半定量分析(Spectrum Quantification)** —包含定性與定量分析報告書
  - ◆ 委託測量: 1000元/區 ; 自行操作: 600元
- ◆ **Objection 多點/區分析**—包含定性與定量分析報告書
  - ◆ 委託測量: 1000 元/區 ; 自行操作: 600 元/區; 一個畫面最多 3 區塊
- ◆ **Line Scan 線分析**—包含相對影像之定性與定量分析報告書
  - ◆ 委託測量: 1000元/線 ; 自行操作: 600元/線
- ◆ **Mapping 面元素分佈定性分析**—包含相對影像之各別定性分佈分析報告書
  - ◆ 委託測量: 3000元/區 ; 自行操作: 1800元/區

---根據樣品之研究需求與條件選擇合適之分析模式---