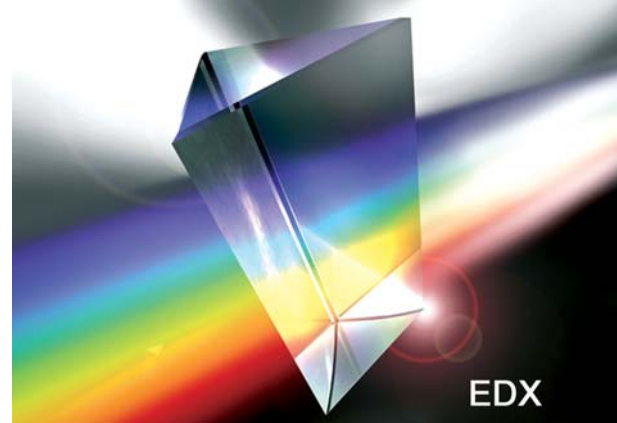


Application Note

Analysis of Trace Elements in Water using Ultra Thin Film (1)



When analyzing water solution using the EDX, the detectable and quantifiable concentration range was in the ppm or higher level for the conventional solution measuring method and the spotting filter paper method, where the sample was spotted and dried on filter paper. By replacing the filter paper with ultra thin polymer film, however, quantum improvements have been made to the S/N ratio, enabling detection and quantification to the ppb level. The following introduces the pretreatment and the qualitative results and lower detection limits for trace elements in a sample.

Ultra Thin Polymer Film

A 0.15 μm polyimide film is stretched in midair across sample holders. A 2 mm diameter section in the center of the film is specially prepared to gather the precipitate after the sample has been dried (see Figs. 1 and 2).

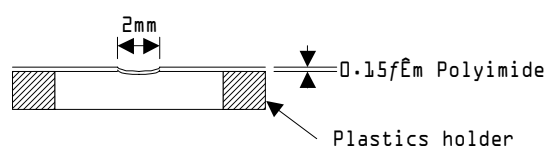


Fig.1 Ultra thin polymer film and sample holder

Sample Preparation

Fifty μL of sample solution was dropped using a micro pipette, and was dried at 70 $^{\circ}\text{C}$ for 40 minutes in a drier (see Fig. 2). Fig. 3 shows the image of the dried sample observed using the optional CCD camera.

Sample

NIST 1643d Trace Elements in Water
Table 1 shows the standard values.

Qualitative Analysis

Fig. 4 shows the qualitative analysis results for NIST 1643d. The upper graph shows the result obtained without the filter, while the lower graphs show the results obtained using a Ti filter and a Ni filter, respectively.

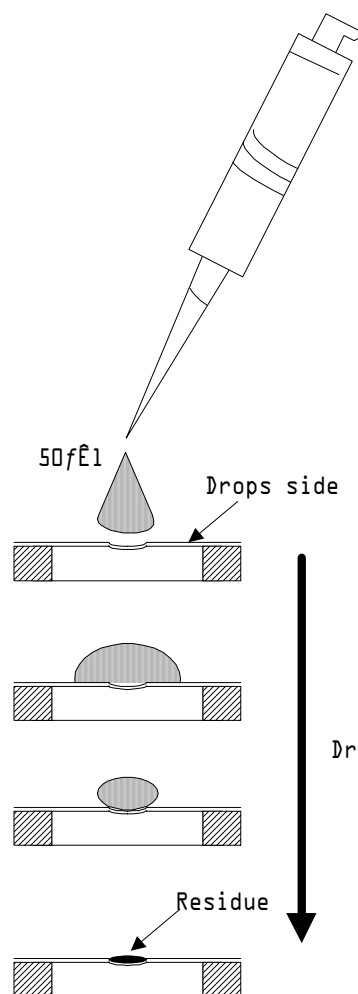


Fig.2 Sample preparation(Drop & Dry)

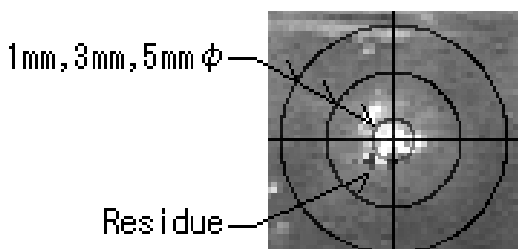


Fig.3 Picture of sample after dry

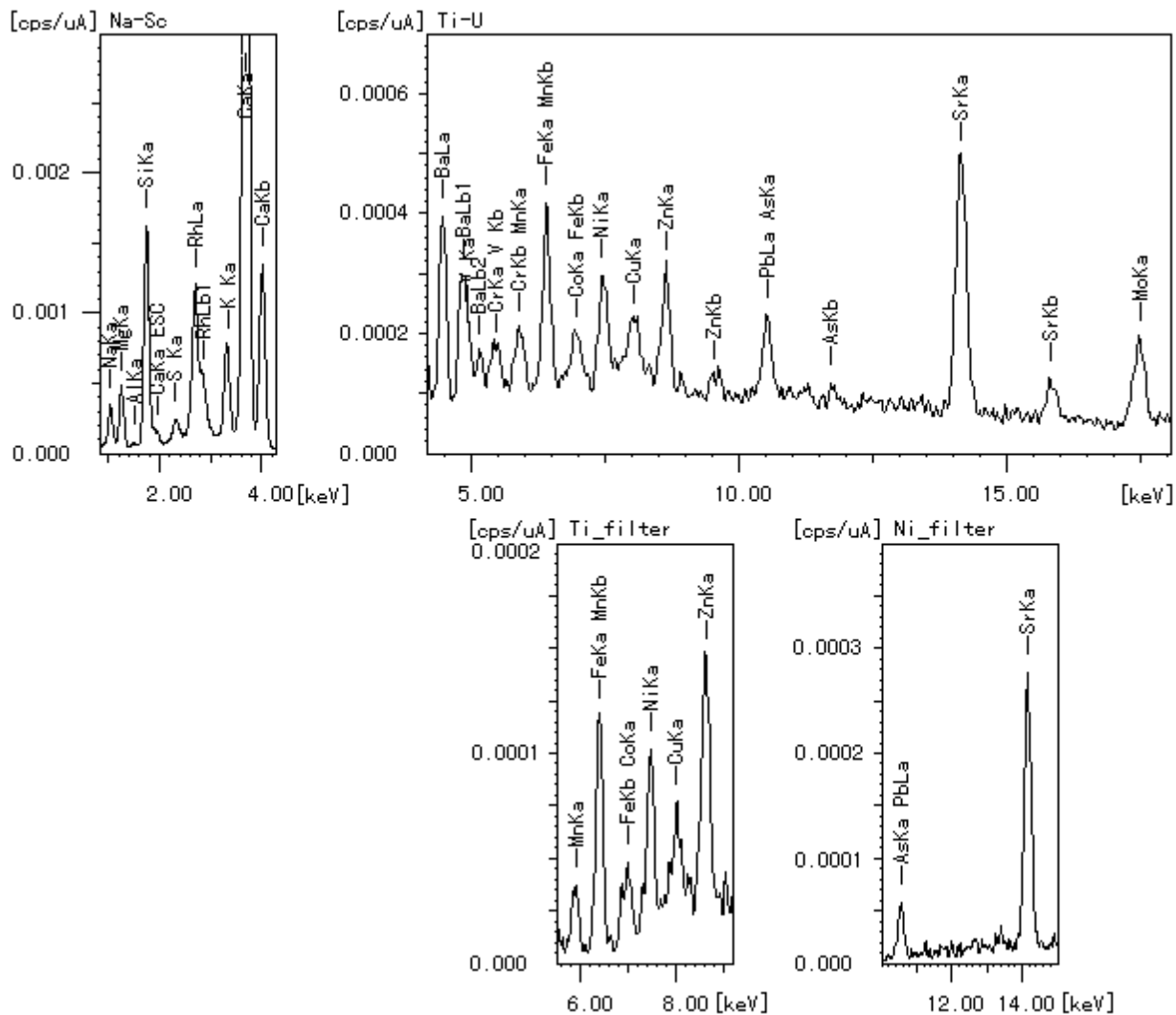


Fig. 4 Qualitative Analysis of NIST1643d

Table 1: Certified or reference Mass Concentrations for 1643d µg/L (ppb) and LLD

Na	22.07 *	1911ppb
Mg	7.989*	406
Al	127.6	--
Si	2.7*	44
K	2.365*	121
Ca	31.04*	--
V	35.1	--
Cr	18.53	--
Mn	37.66	12
Fe	91.2	10
Co	25.00	18
Ni	58.1	15
Cu	20.5	--
Zn	72.48	15
As	56.02	15
Sr	294.8	18
Mo	112.9	22
Ba	506.5	65
Pb	18.15	--

*marked :mg/L(ppm), --Not calculated

Lower Limits of Detection(L.L.D)

Table 1 shows the lower limits of detection calculated from the intensities of the detected elements. The calculation formula is as follows:

$$L.L.D = 3 \times (BG/T)^{1/2} \times C/NET$$

where BG: background,

NET: net intensity (cps),

T: measurement time (sec),

C: reference value (ppm/ppb).

Analytical Conditions

Instrument:	EDX-700
X-ray Tube:	Rh target
Filter:	without Ti, Ni
Voltage - Current:	50kV-(Auto) 15kV-(Auto)
Atmosphere:	Air, Vacuum
Measurement Diameter:	3 mm
Measurement Time:	1000 sec
Dead Time:	0-12 %

The given specifications serve purely as technical information for the user. No guarantee is given on technical specification of the described product and/or procedures.