BRAUER X25

Reference X-ray Spectra of Metal Foils

The x-ray spectra compiled here for the following metal foils were recorded at synchrotron beamlines 1-5, 4-2 and 7-3 at SSRL using Si(220) double crystal The spectra of Ag, Pt and Au were recorded with Si(111) on beamline X -11A at NSLS. All spectra were taken at room temperature in the transmission geometry. In the region -50 eV to +50 eV about the absorption edge, each spectrum was scanned in step sizes of 0.5 eV. An entrance slit of 1mm and 0.5 mm was used for Si(220) and Si(111) respectively. The spectrometer resolution is estimated to be ~0.5 eV at the K-edge of Ti and ~1.5 eV at the K-edge of Cu. For each element, the tabulated edge energy (Bearden & Burr, Rev. Mod, Phys. 39, 125 (1967)) is taken at the first inflection point in the derivative spectrum.

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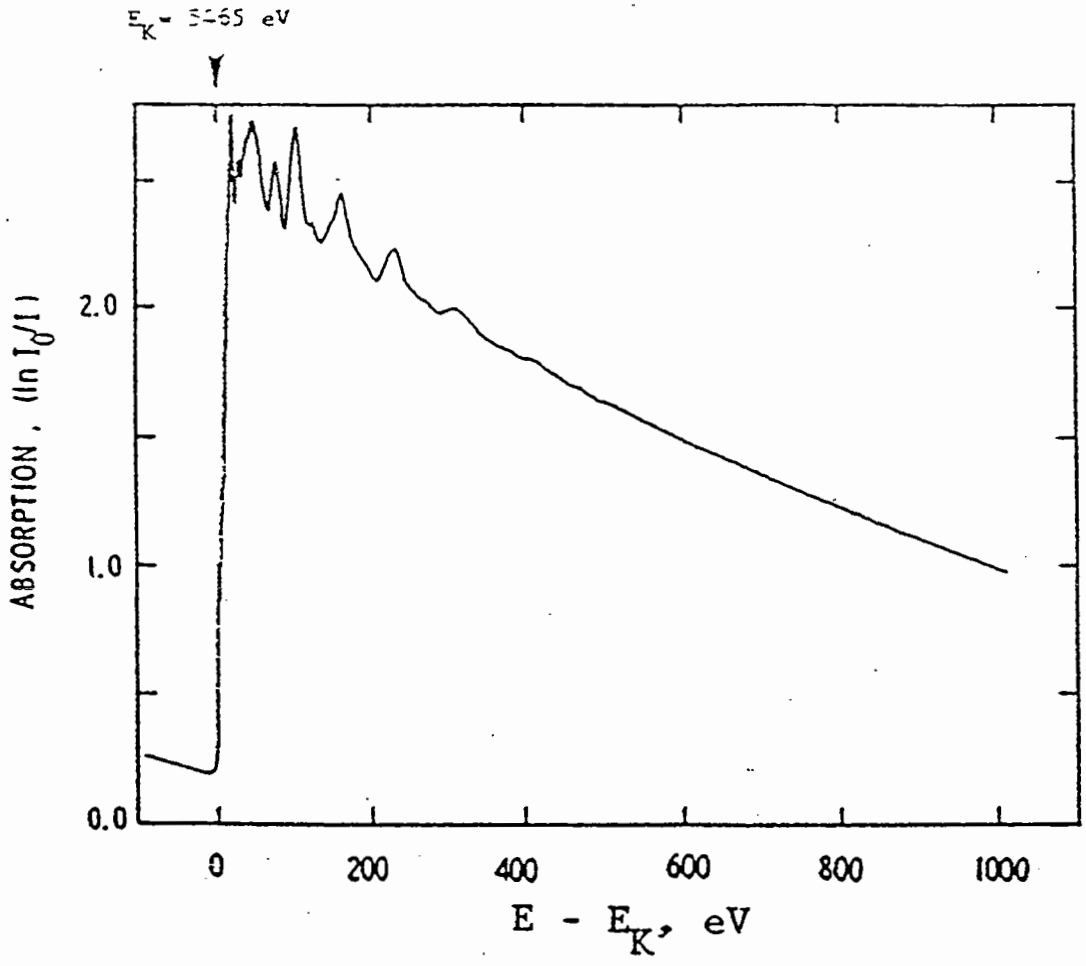
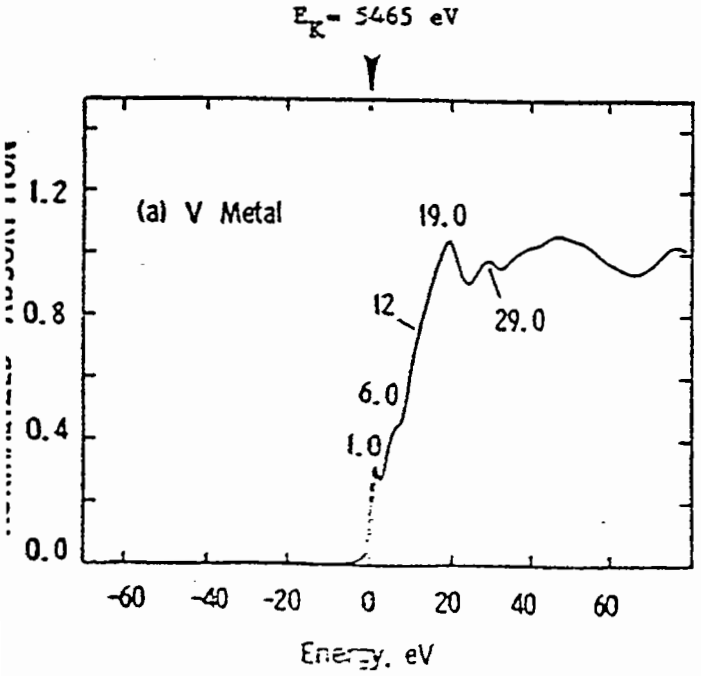
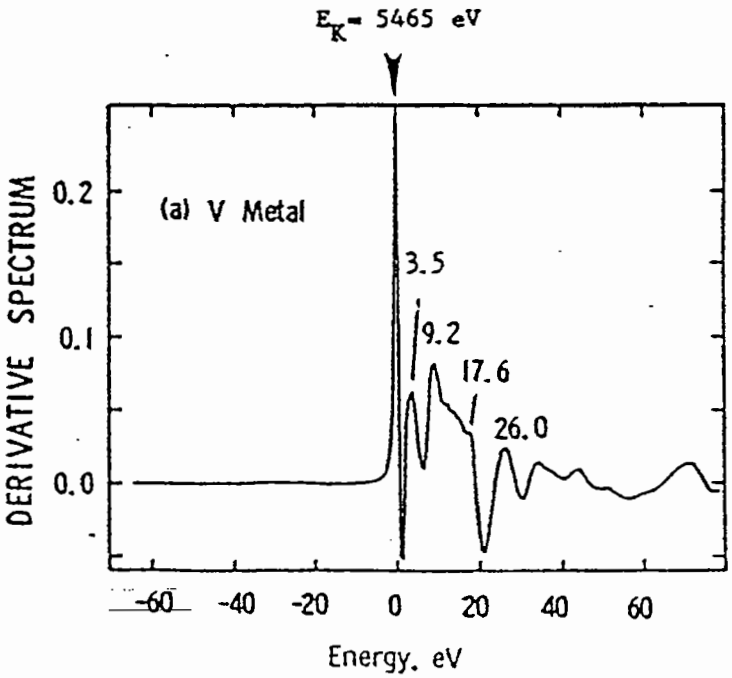
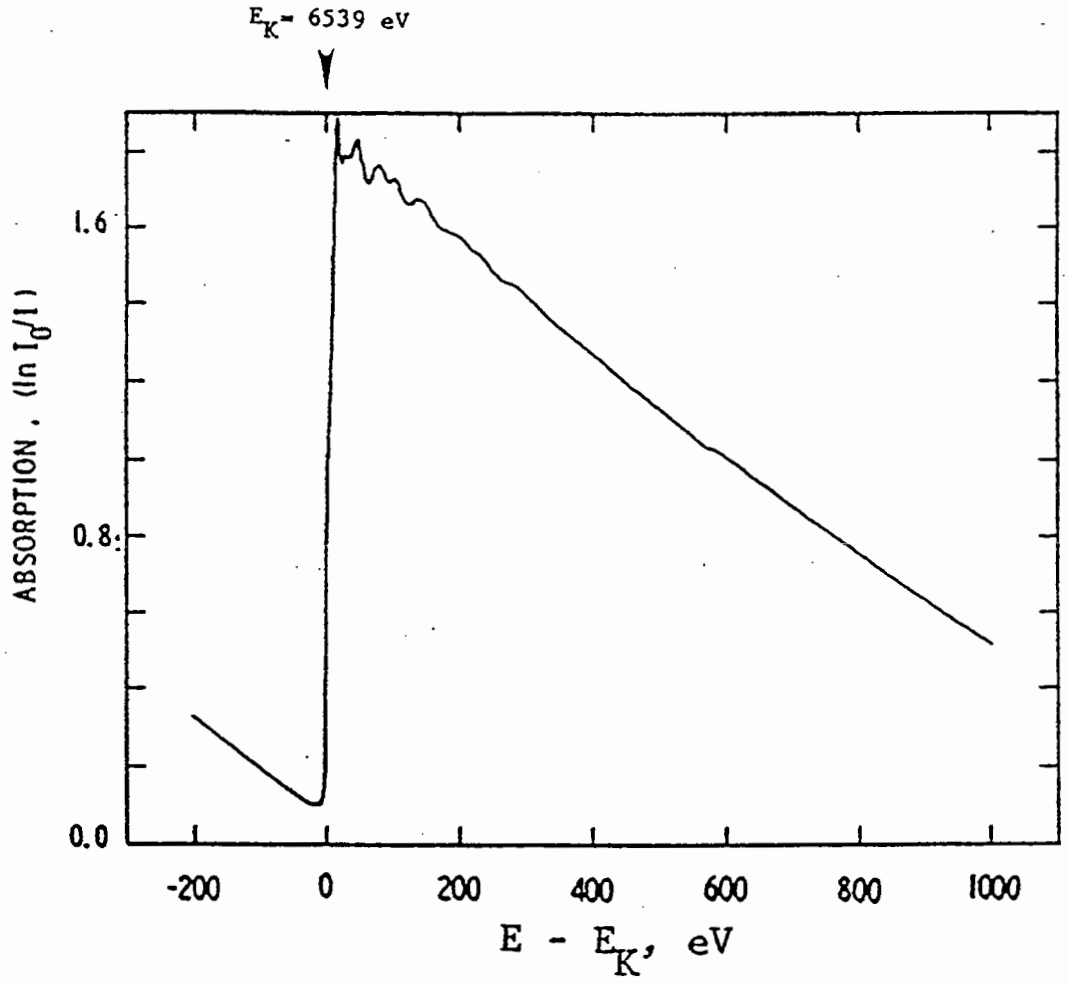
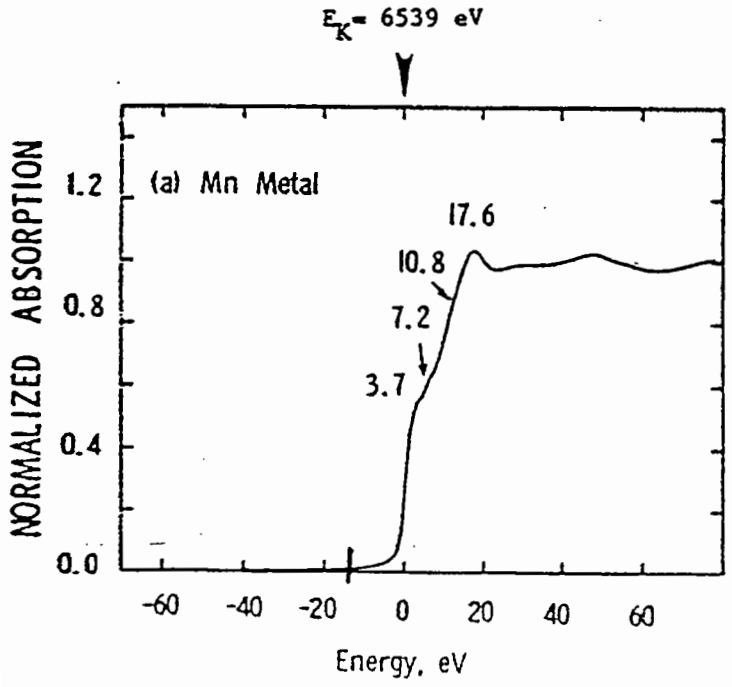
~27~

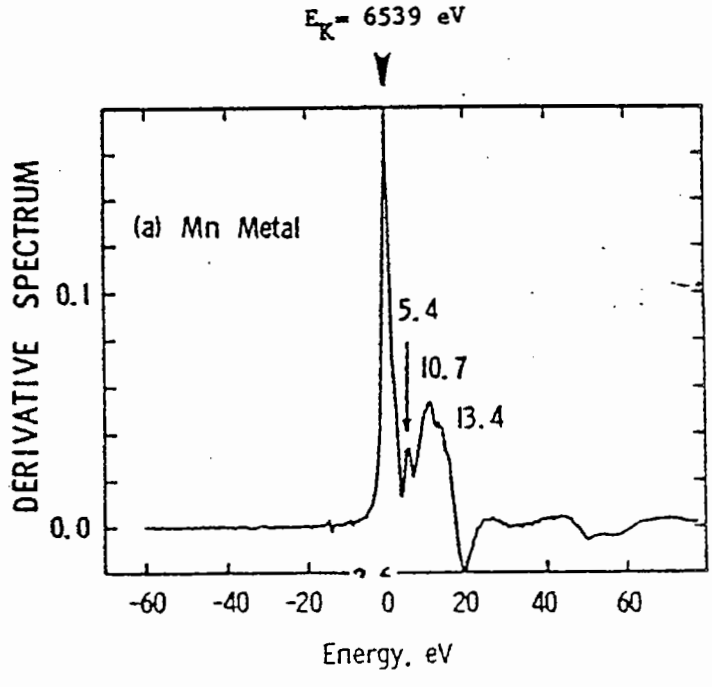

E_K = 5465 eV
ABSORPTION, (ln I_0/I)
2.0
1.0
0.0
0
200
400
600
800
1000
E - E_K, eV


E_K = 5465 eV
(a) V Metal
19.0
12
29.0
6.0
1.0
1.2
0.8
0.4
0.0
-60
-40
-20
0
20
40
60
Energy, eV

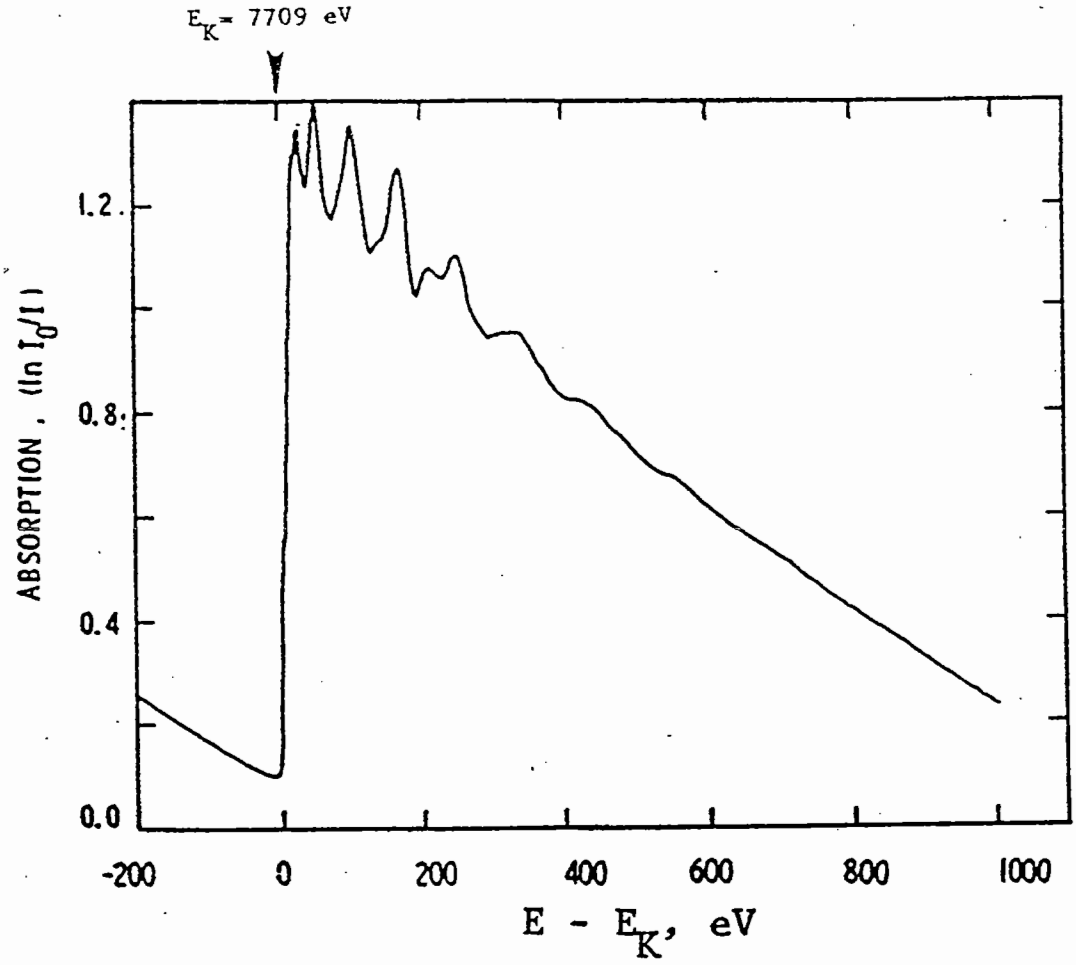

E_K = 5465 eV
(a) V Metal
DERIVATIVE SPECTRUM
3.5
9.2
17.6
26.0
0.2
0.1
0.0
-60
-40
-20
0
20
40
60
Energy, eV

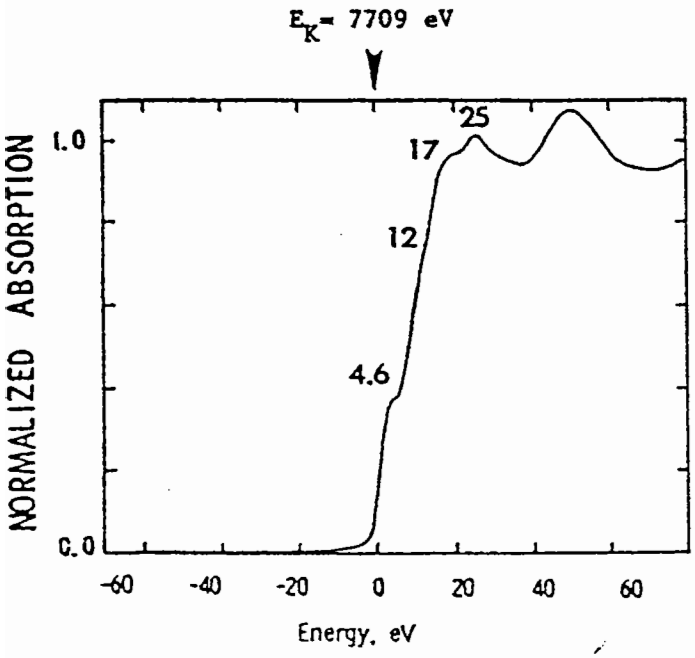

E_K= 6539 eV
ABSORPTION , (ln I_0/I)
1.6
0.8
0.0
-200
0
200
400
600
800
1000
E - E_K, eV

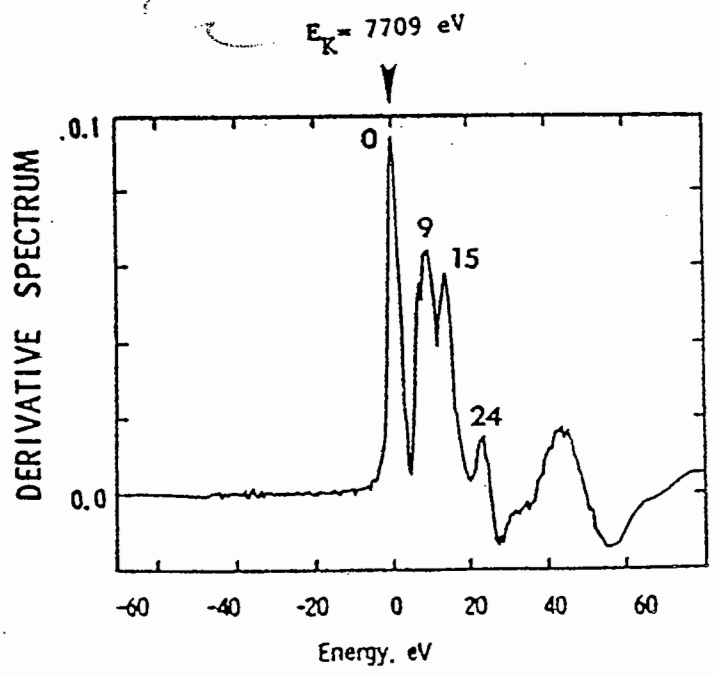

E_K= 6539 eV
NORMALIZED ABSORPTION
(a) Mn Metal
17.6
10.8
7.2
3.7
1.2
0.8
0.4
0.0
-60
-40
-20
0
20
40
60
Energy, eV


E_K= 6539 eV
DERIVATIVE SPECTRUM
(a) Mn Metal
5.4
10.7
13.4
0.1
0.0
-60
-40
-20
0
20
40
60
Energy, eV

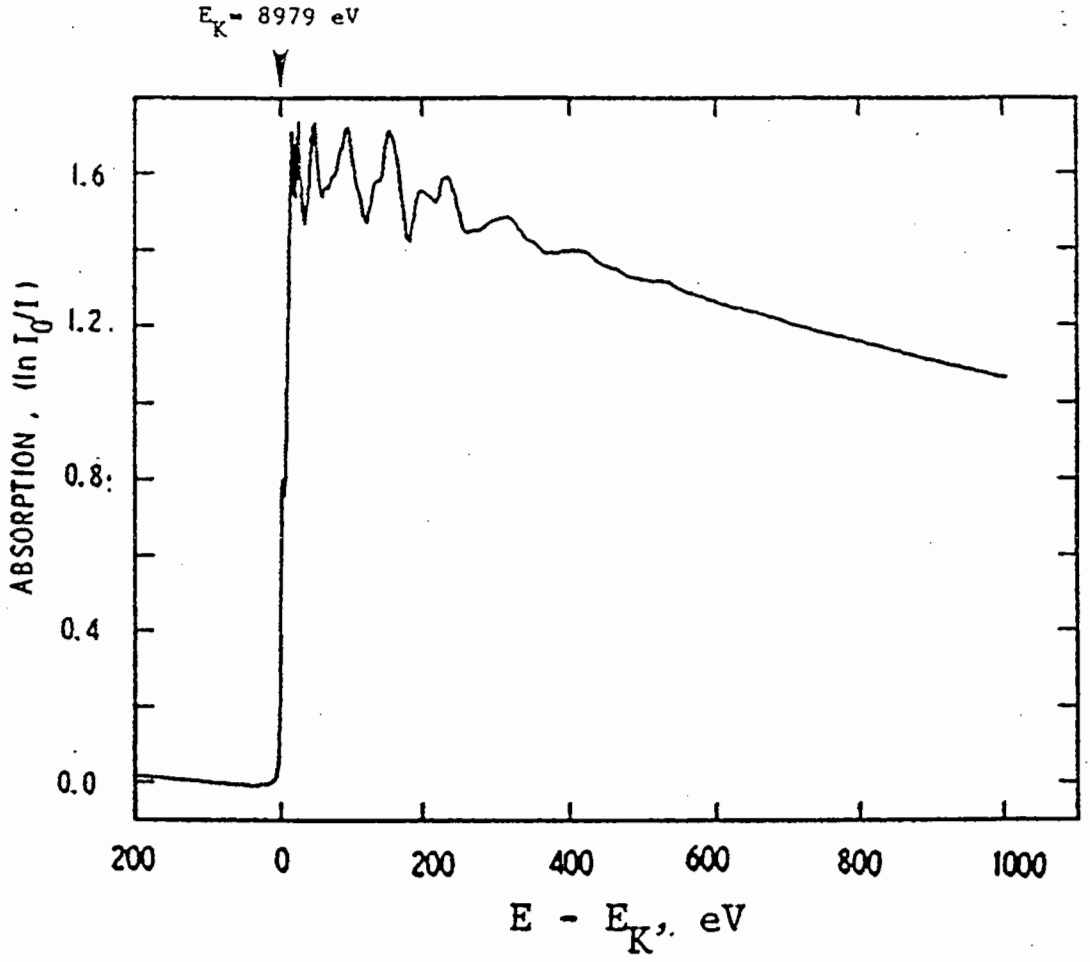
Co

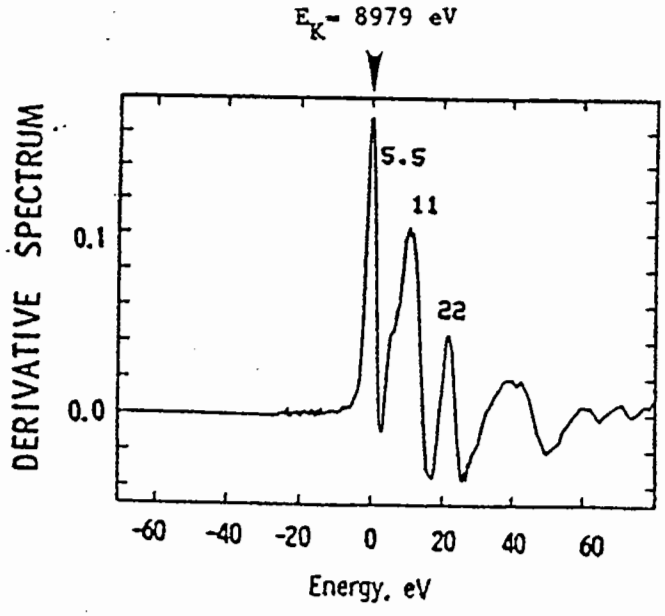

E_K = 7709 eV
ABSORPTION , (ln I_0/I)
1.2
0.8
0.4
0.0
-200
0
200
400
600
800
1000
E - E_K, eV

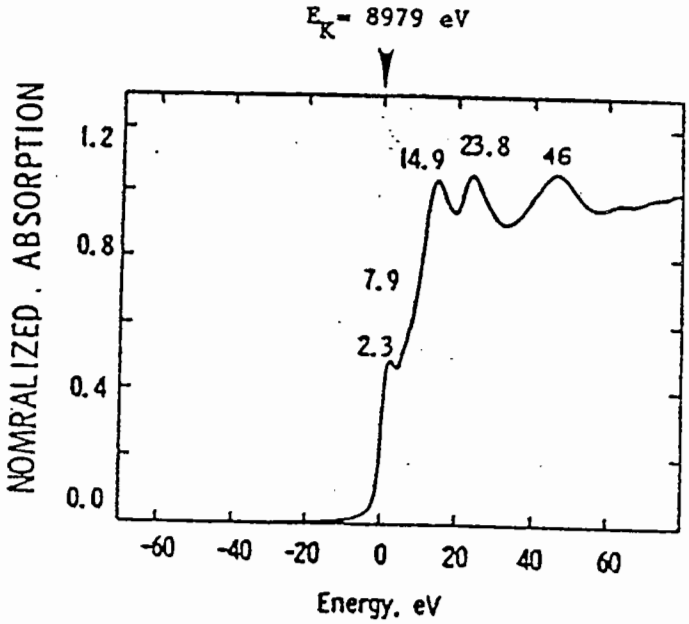

E_K = 7709 eV
NORMALIZED ABSORPTION
1.0
0.0
25
17
12
4.6
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 7709 eV
DERIVATIVE SPECTRUM
.0.1
0.0
0
9
15
24
-60
-40
-20
0
20
40
60
Energy, eV

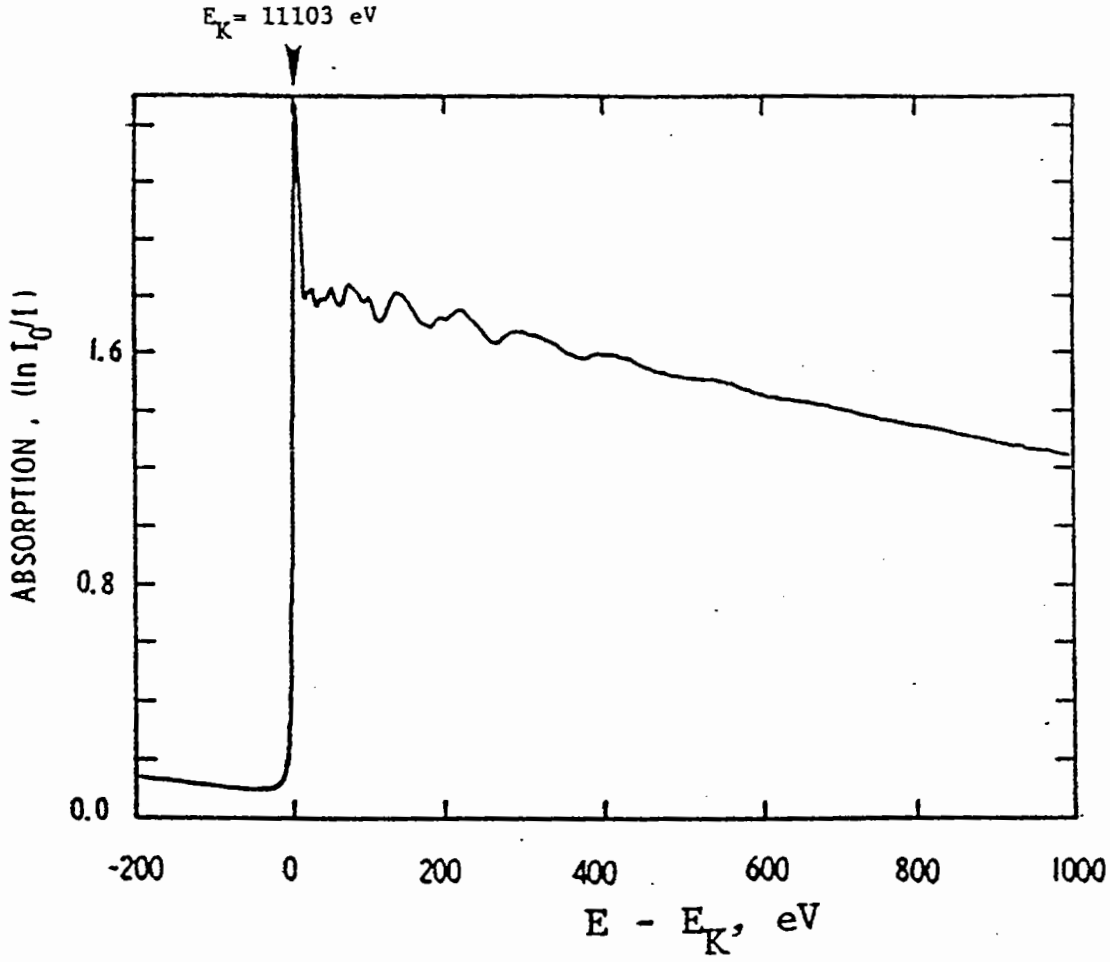
Cu

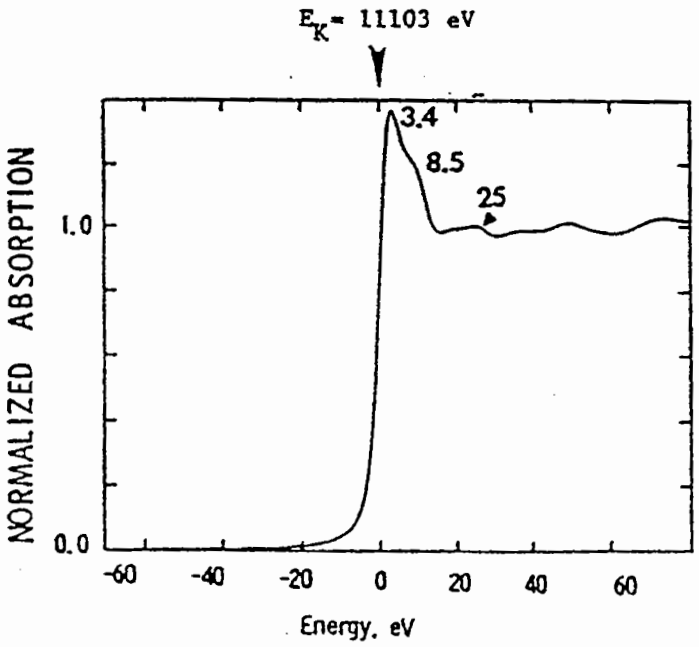

E_K = 8979 eV
ABSORPTION , (ln I_0/I)
1.6
1.2
0.8
0.4
0.0
200
0
200
400
600
800
1000
E - E_K, eV

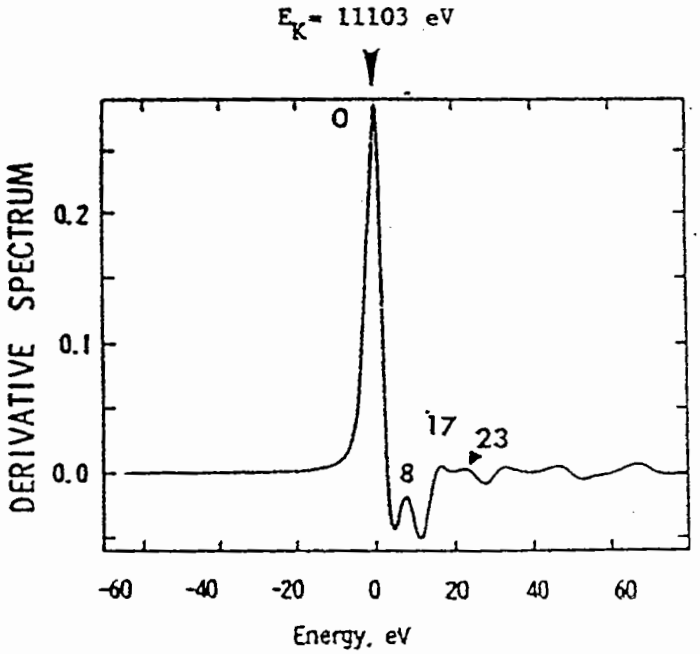

E_K = 8979 eV
DERIVATIVE SPECTRUM
5.5
11
22
0.1
0.0
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 8979 eV
NOMRALIZED . ABSORPTION
14.9
23.8
46
7.9
2.3
1.2
0.8
0.4
0.0
-60
-40
-20
0
20
40
60
Energy, eV

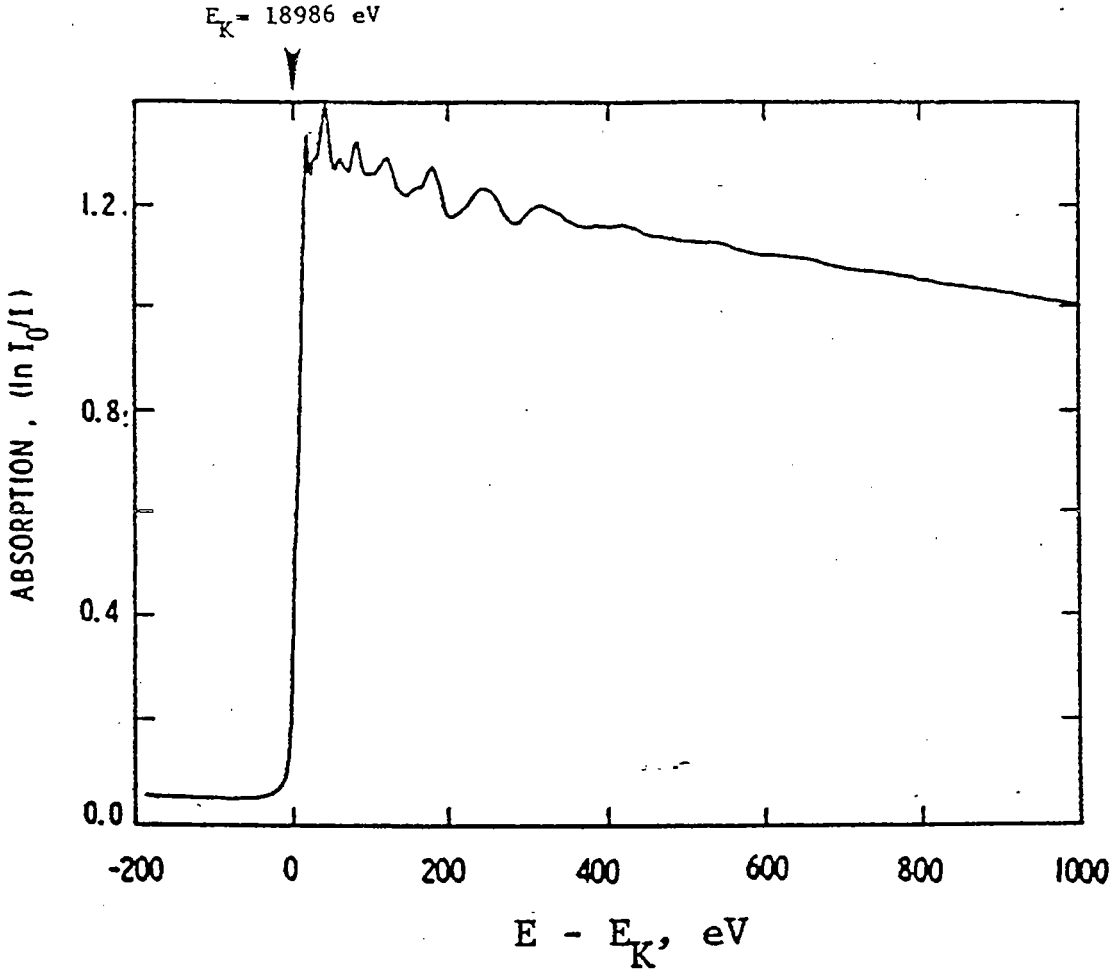
Ge

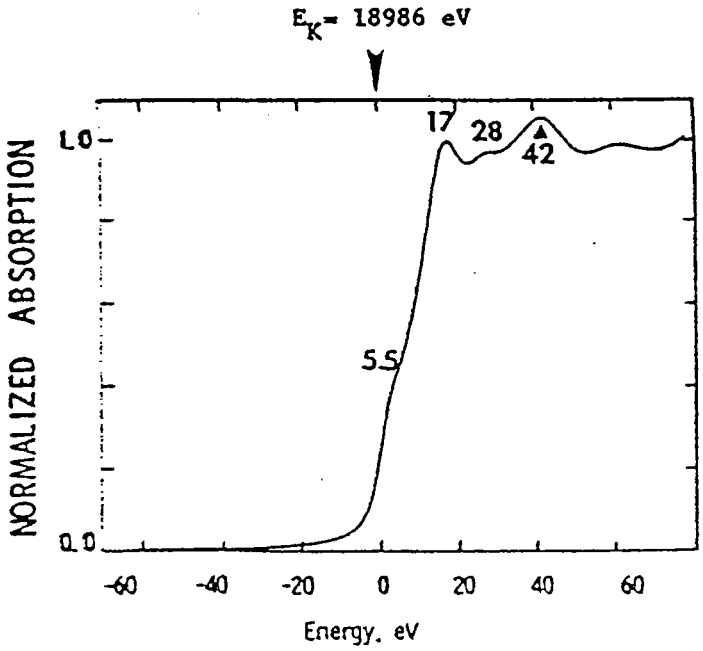

E_K = 11103 eV
ABSORPTION , (ln I_0/I)
1.6
0.8
0.0
-200
0
200
400
600
800
1000
E - E_K, eV

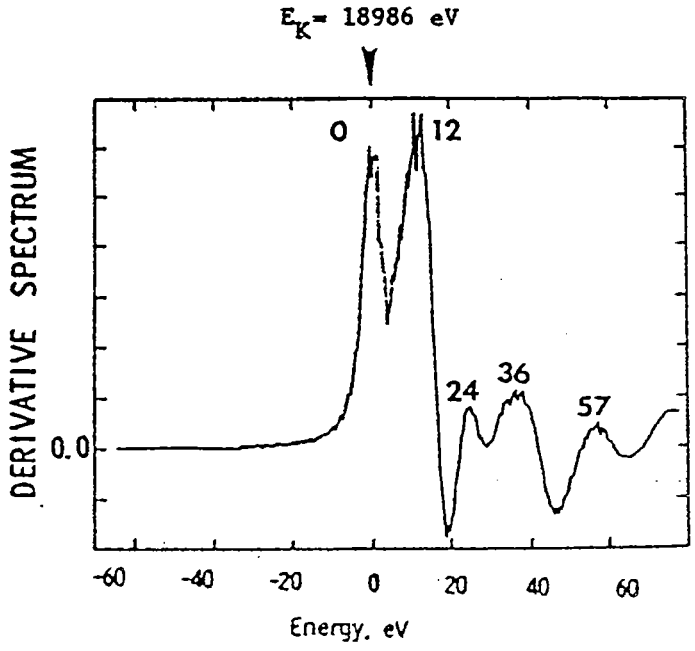

E_K = 11103 eV
NORMALIZED ABSORPTION
1.0
0.0
3.4
8.5
25
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 11103 eV
DERIVATIVE SPECTRUM
0.2
0.1
0.0
0
17
23
8
-60
-40
-20
0
20
40
60
Energy, eV

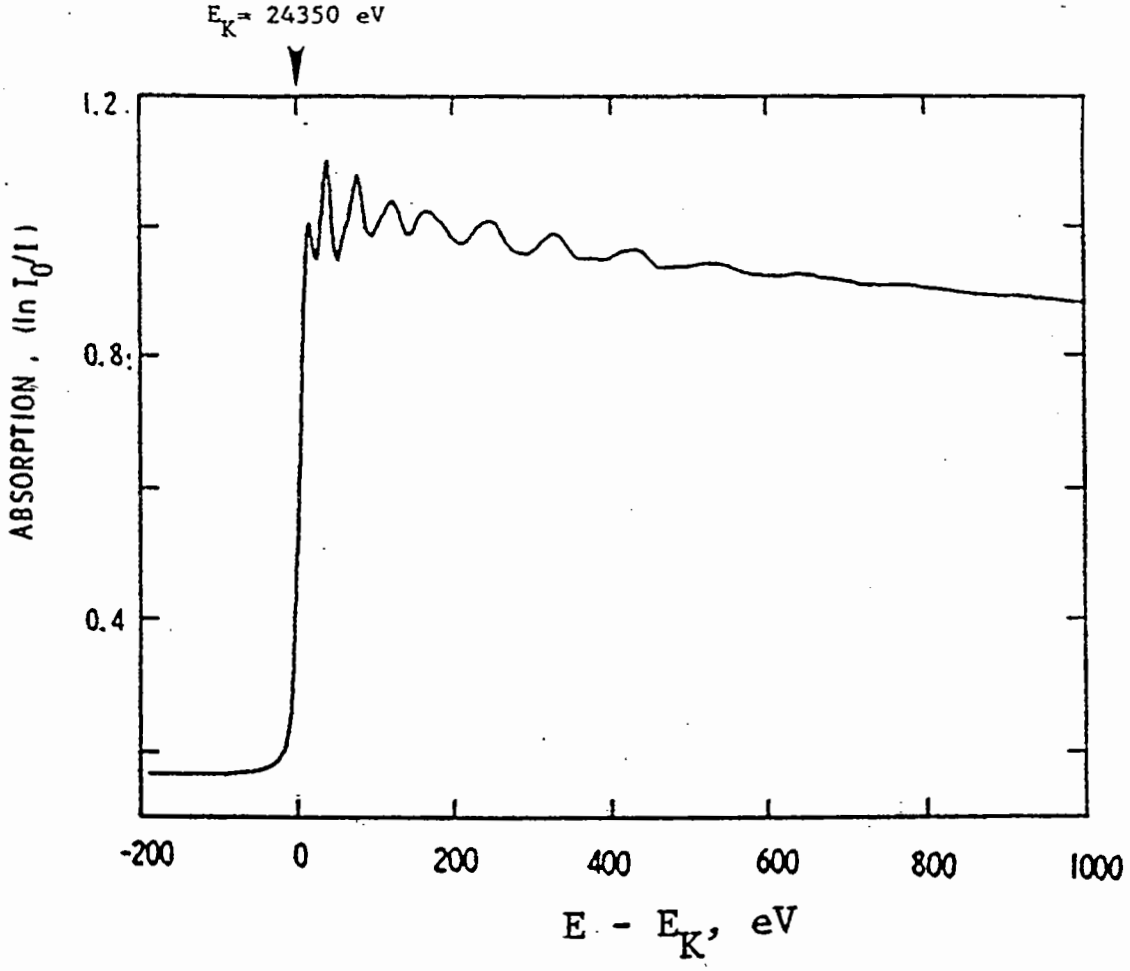
Nb

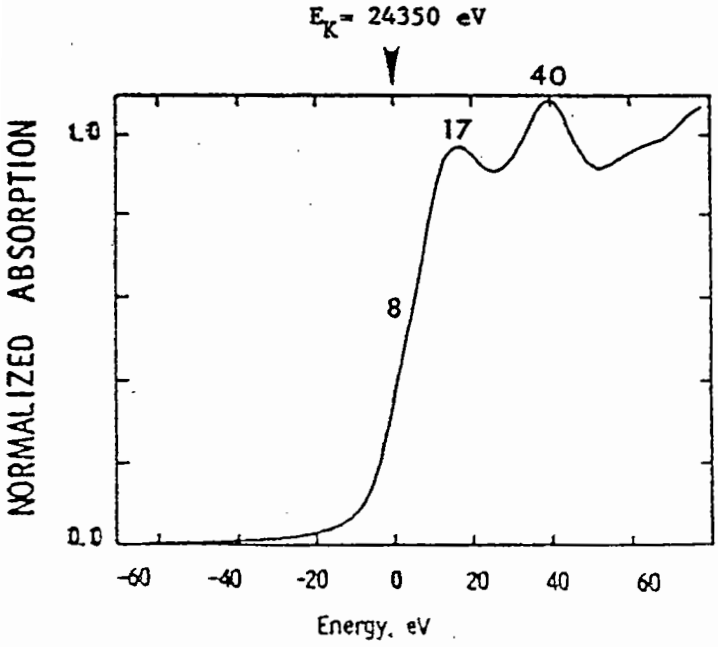

E_K = 18986 eV
ABSORPTION , (ln I_0/I)
1.2
0.8
0.4
0.0
-200
0
200
400
600
800
1000
E - E_K, eV

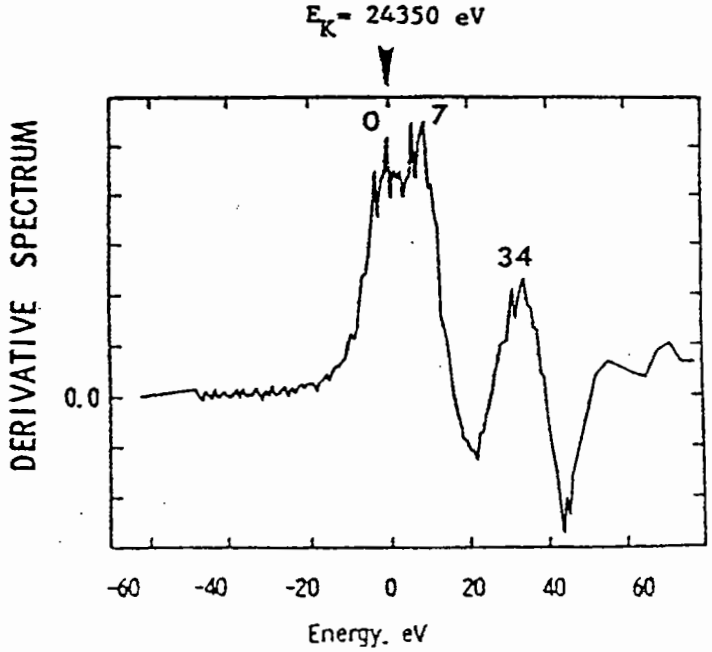

E_K = 18986 eV
NORMALIZED ABSORPTION
1.0
0.0
17
28
42
5.5
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 18986 eV
DERIVATIVE SPECTRUM
0.0
0
12
24
36
57
-60
-40
-20
0
20
40
60
Energy, eV

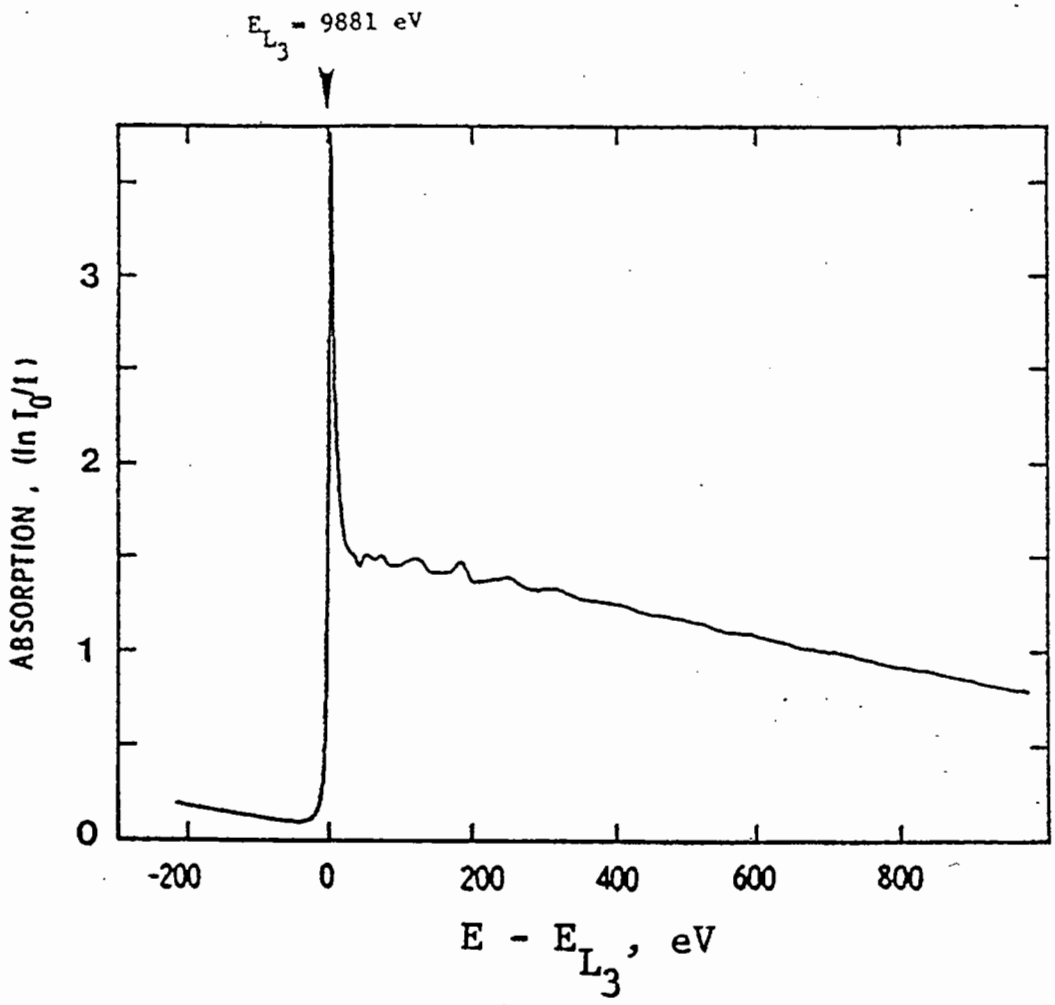
Pd

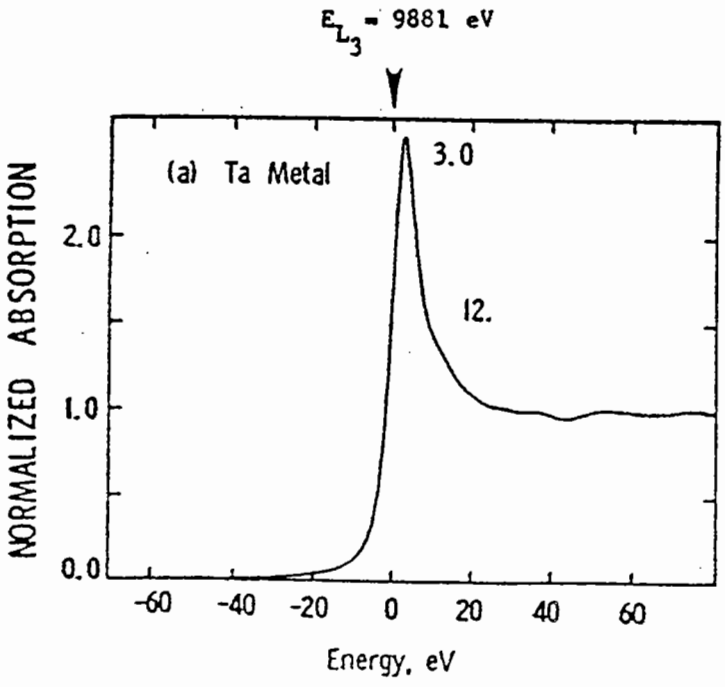

E_K = 24350 eV
1.2
0.8
0.4
ABSORPTION , (ln I_0/I)
-200
0
200
400
600
800
1000
E - E_K, eV

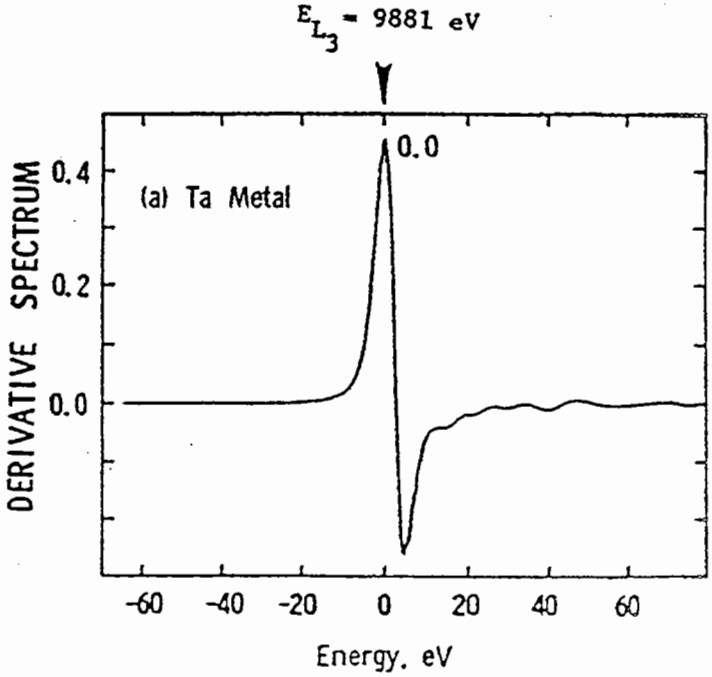

E_K = 24350 eV
40
17
8
1.0
0.0
NORMALIZED ABSORPTION
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 24350 eV
0
7
34
0.0
DERIVATIVE SPECTRUM
-60
-40
-20
0
20
40
60
Energy, eV

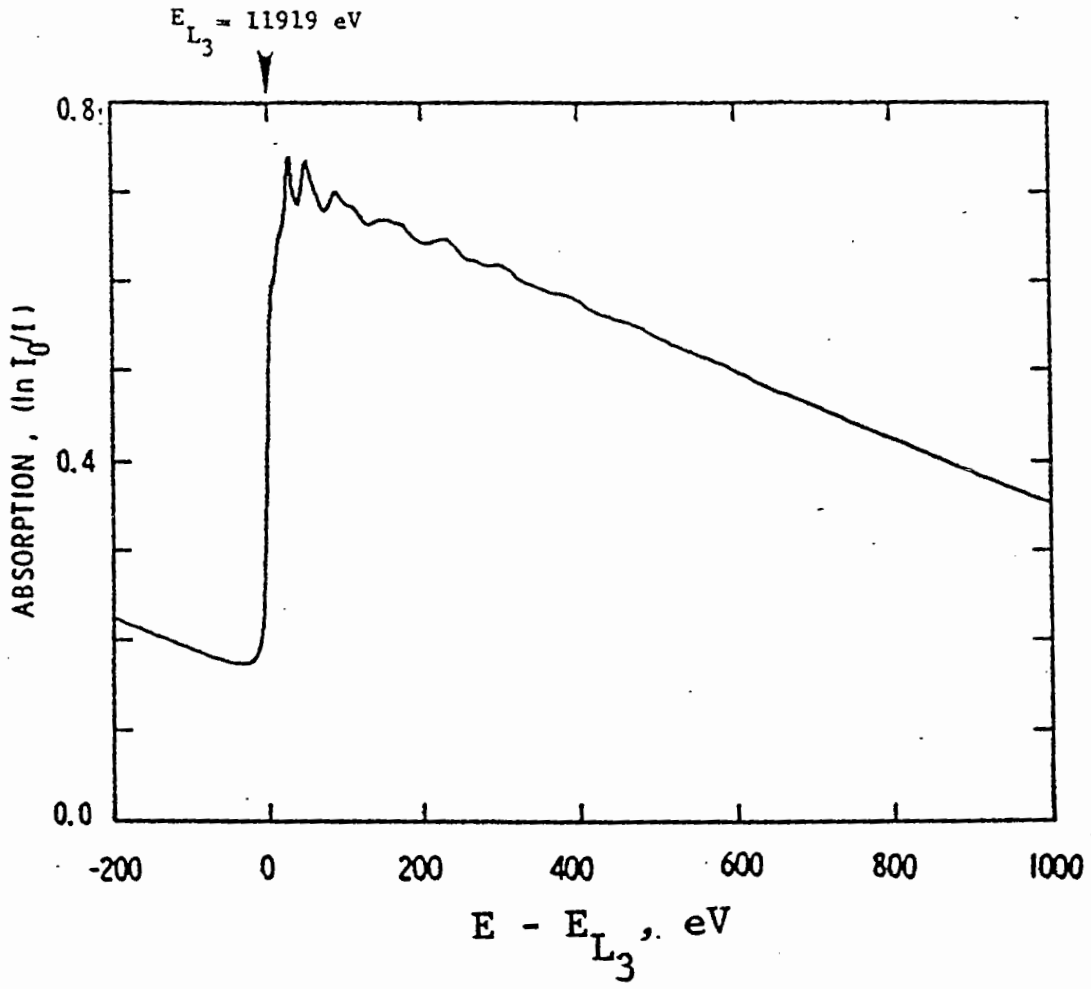
Ta

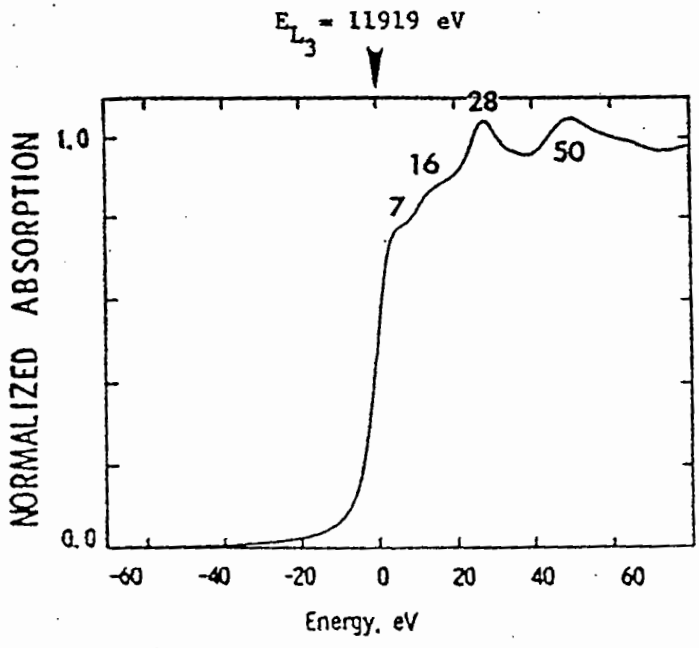

E_{L_3} = 9881 eV
ABSORPTION , (ln I_0/I)
0
1
2
3
-200
0
200
400
600
800
E - E_{L_3}, eV

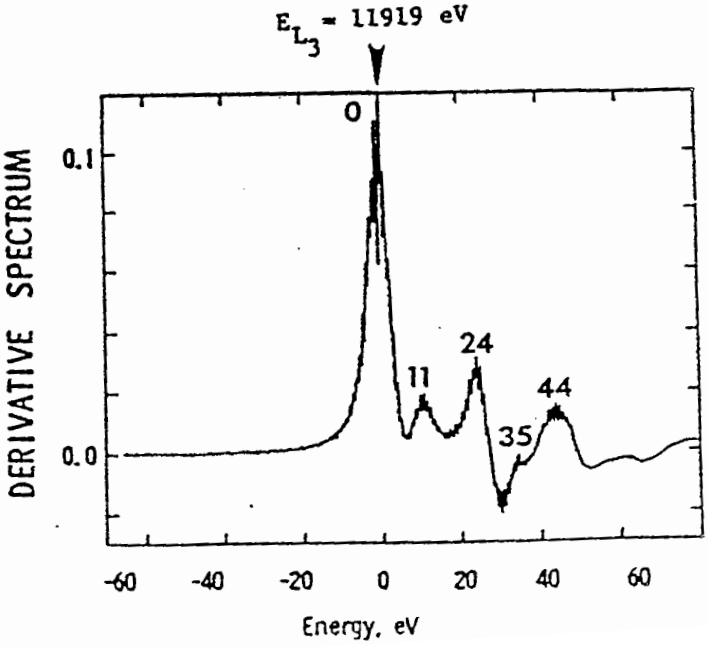

E_{L_3} = 9881 eV
(a) Ta Metal
3.0
12.
NORMALIZED ABSORPTION
0.0
1.0
2.0
-60
-40
-20
0
20
40
60
Energy, eV


E_{L_3} = 9881 eV
(a) Ta Metal
0.0
DERIVATIVE SPECTRUM
0.0
0.2
0.4
-60
-40
-20
0
20
40
60
Energy, eV

Au


E_{L_3} = 11919 eV
0.8
0.4
0.0
ABSORPTION, (ln I_0/I)
-200
0
200
400
600
800
1000
E - E_{L_3}, eV


E_{L_3} = 11919 eV
1.0
0.0
NORMALIZED ABSORPTION
28
16
7
50
-60
-40
-20
0
20
40
60
Energy, eV


E_{L_3} = 11919 eV
0.1
0.0
DERIVATIVE SPECTRUM
0
11
24
35
44
-60
-40
-20
0
20
40
60
Energy, eV

BRAUER X25

Reference X-ray Spectra of Metal Foils

The x-ray spectra compiled here for the following metal foils were recorded at synchrotron beamlines 1-5, 4-2 and 7-3 at SSRL using Si(220) double crystal The spectra of Ag, Pt and Au were recorded with Si(111) on beamline X -11A at NSLS. All spectra were taken at room temperature in the transmission geometry. In the region -50 eV to +50 eV about the absorption edge, each spectrum was scanned in step sizes of 0.5 eV. An entrance slit of 1mm and 0.5 mm was used for Si(220) and Si(111) respectively. The spectrometer resolution is estimated to be ~0.5 eV at the K-edge of Ti and ~1.5 eV at the K-edge of Cu. For each element, the tabulated edge energy (Bearden & Burr, Rev. Mod, Phys. 39, 125 (1967)) is taken at the first inflection point in the derivative spectrum.

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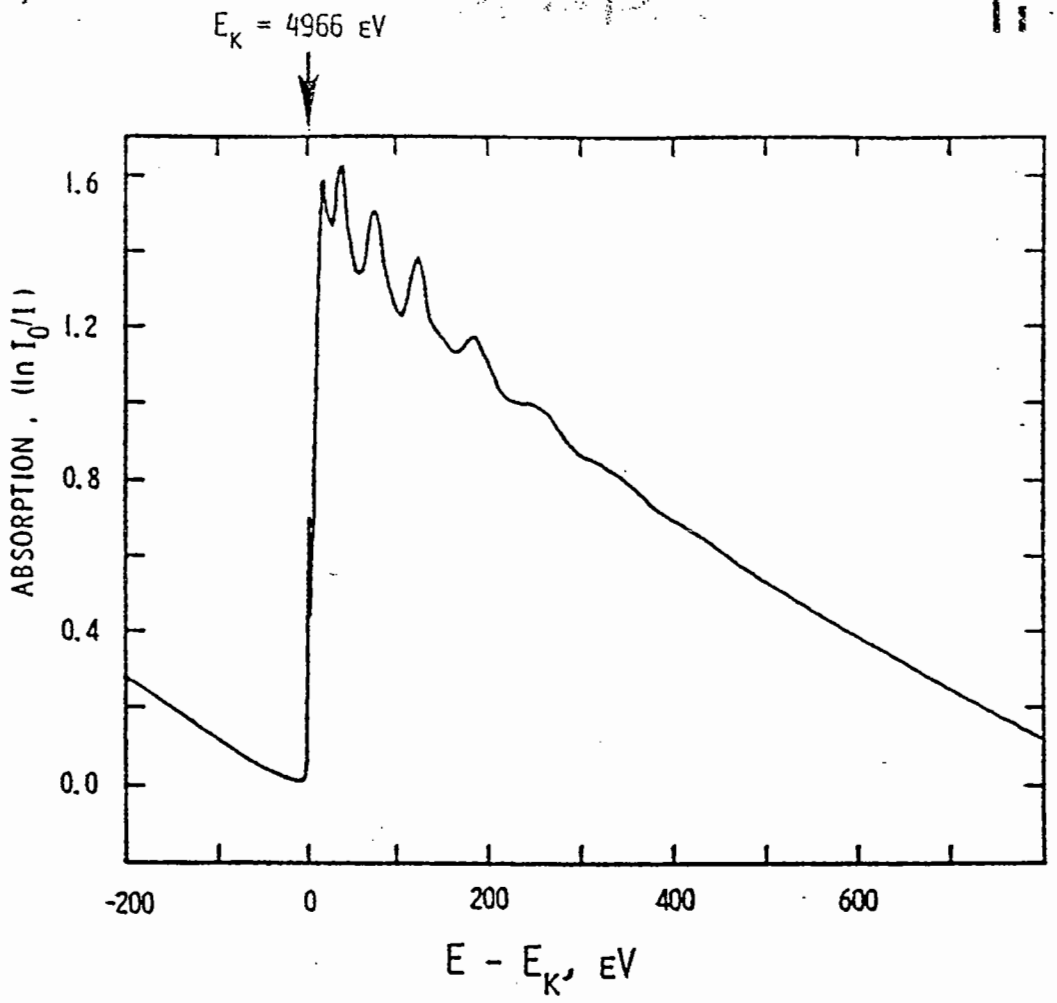
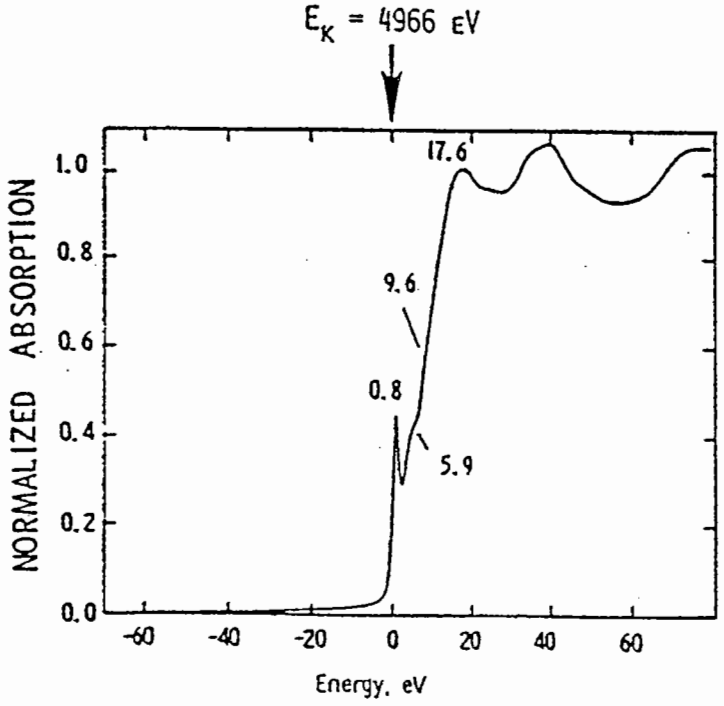
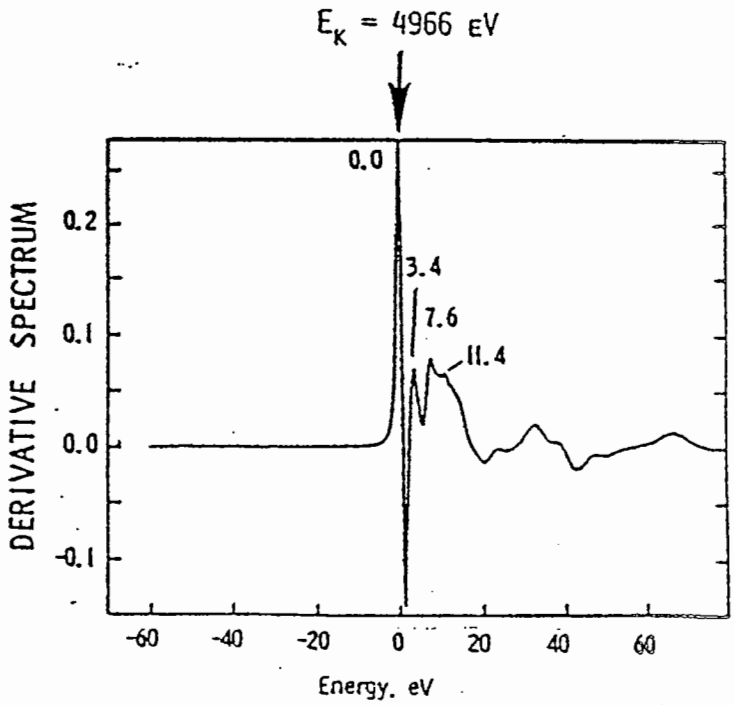
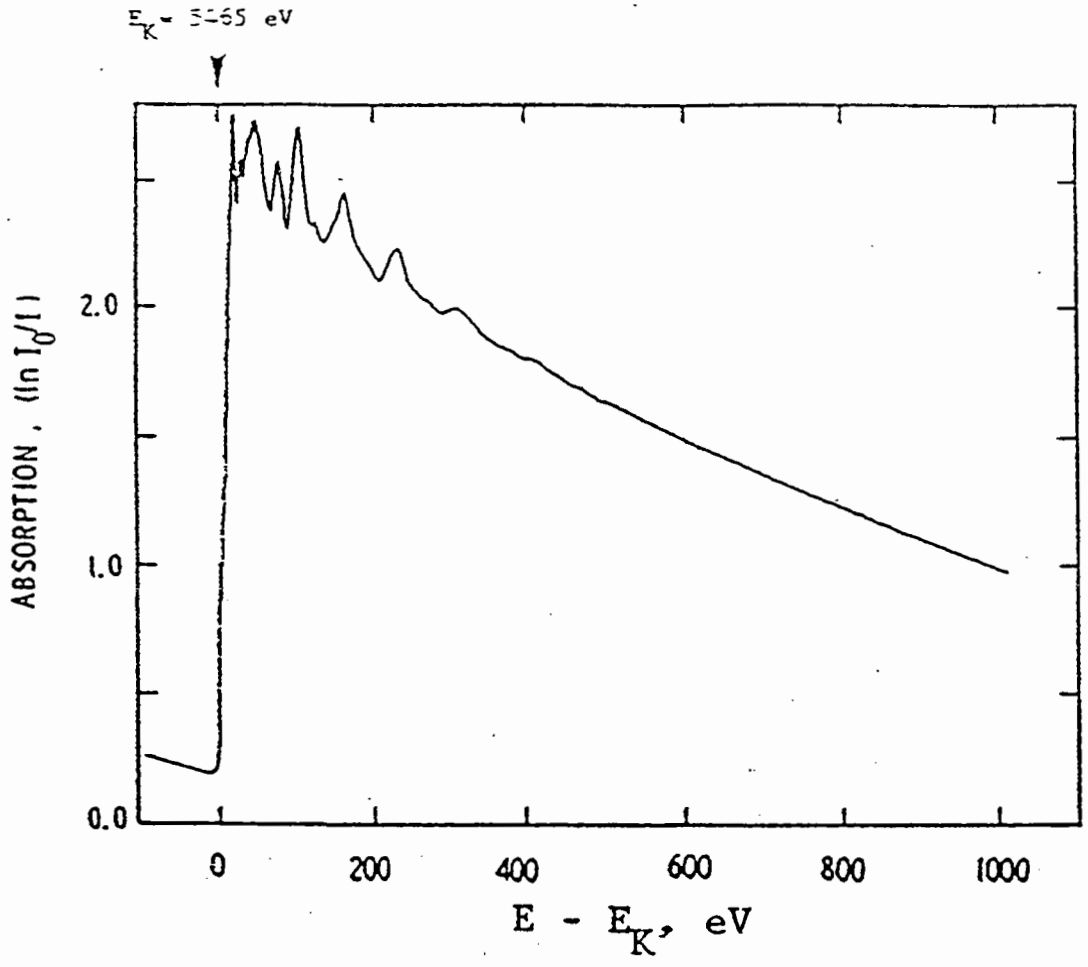
Ti

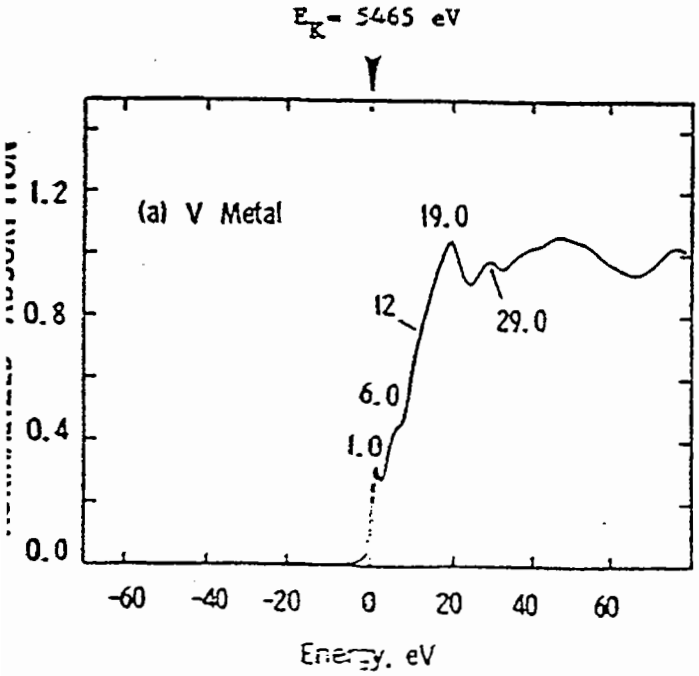

E_K = 4966 eV
ABSORPTION , (ln I_0/I)
1.6
1.2
0.8
0.4
0.0
-200
0
200
400
600
E - E_K, eV

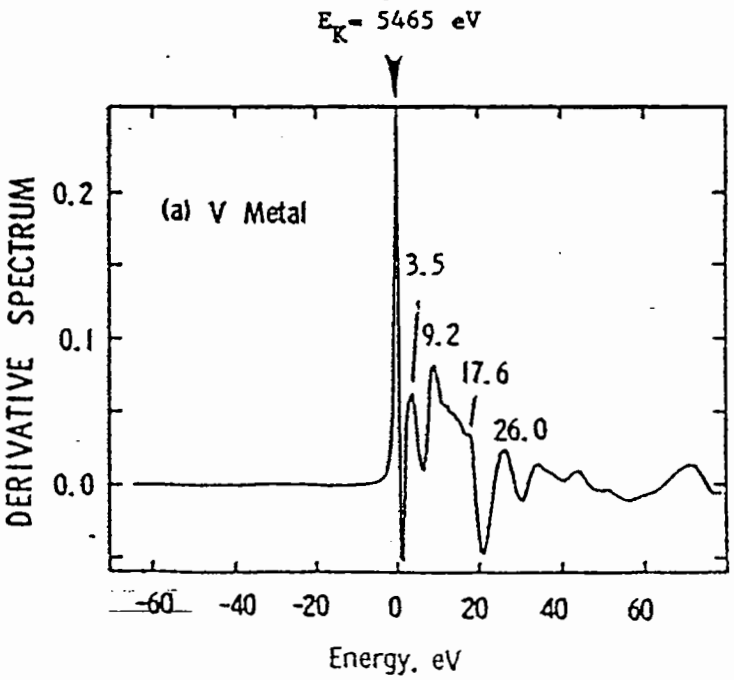

E_K = 4966 eV
NORMALIZED ABSORPTION
1.0
0.8
0.6
0.4
0.2
0.0
17.6
9.6
0.8
5.9
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 4966 eV
DERIVATIVE SPECTRUM
0.2
0.1
0.0
-0.1
0.0
3.4
7.6
11.4
-60
-40
-20
0
20
40
60
Energy, eV

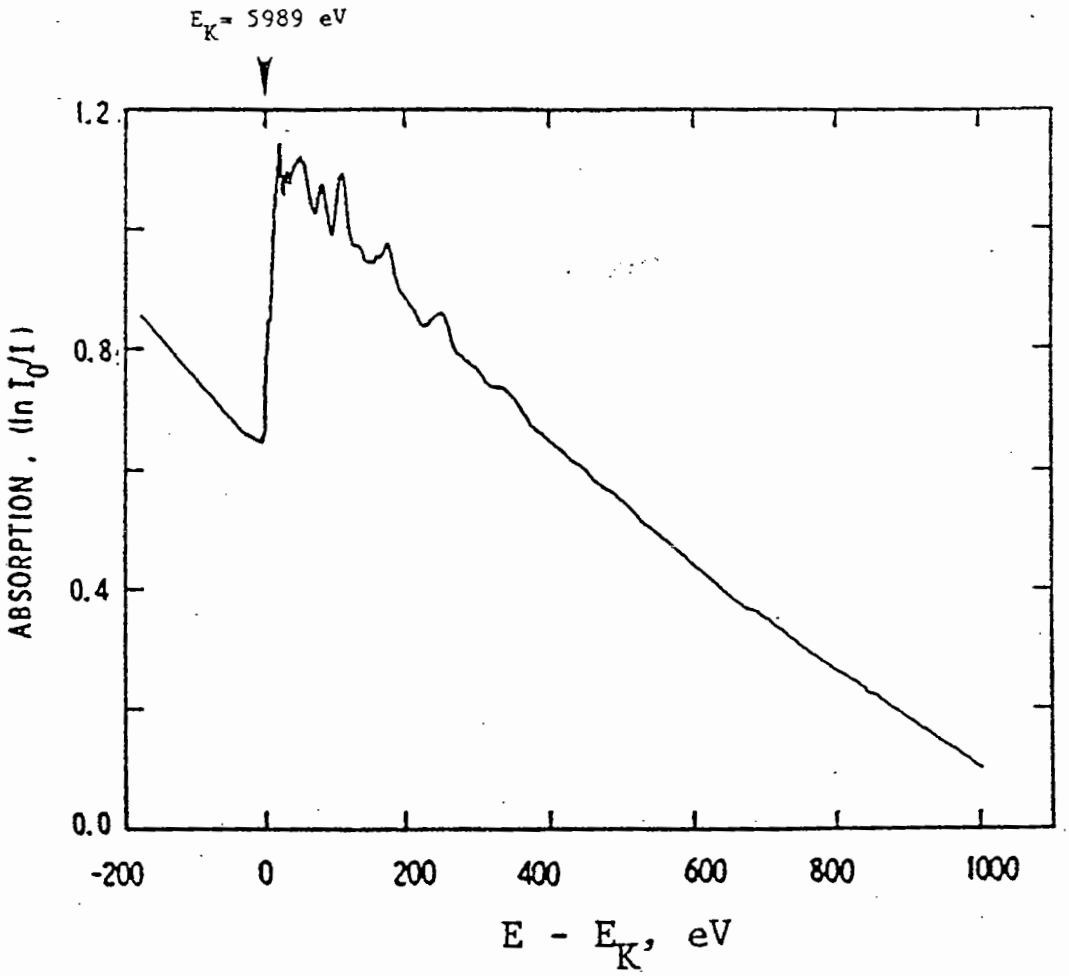
V

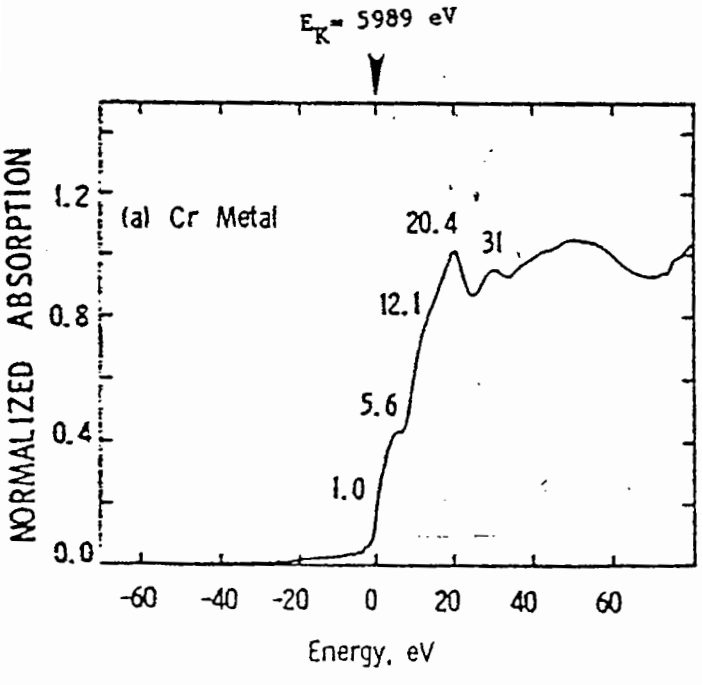

E_K = 5465 eV
ABSORPTION , (ln I_0/I)
2.0
1.0
0.0
0
200
400
600
800
1000
E - E_K, eV

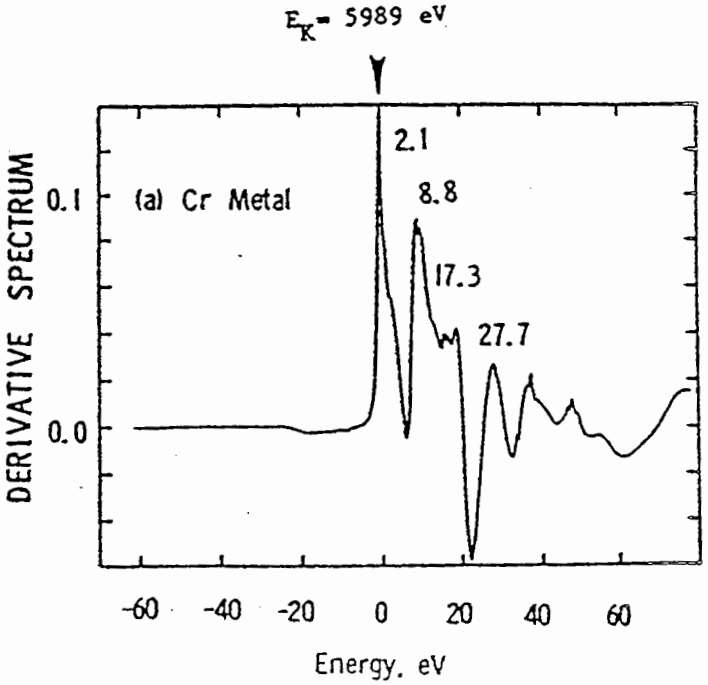

E_K = 5465 eV
(a) V Metal
19.0
12
29.0
6.0
1.0
1.2
0.8
0.4
0.0
-60
-40
-20
0
20
40
60
Energy, eV

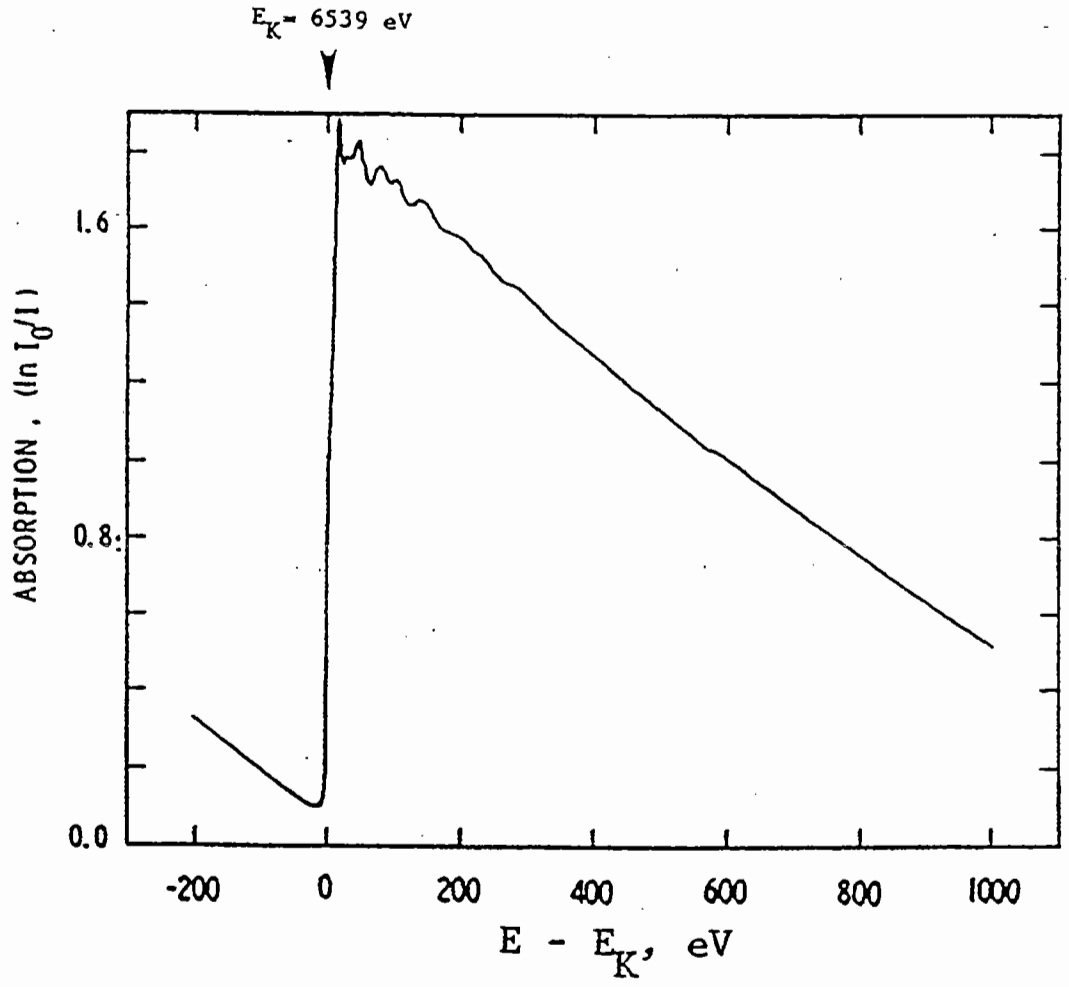

E_K = 5465 eV
DERIVATIVE SPECTRUM
(a) V Metal
3.5
9.2
17.6
26.0
0.2
0.1
0.0
-60
-40
-20
0
20
40
60
Energy, eV

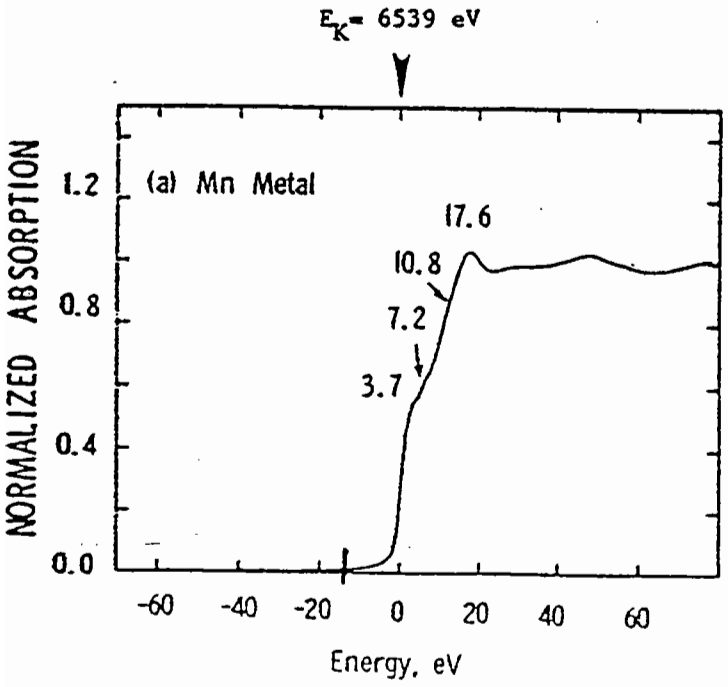
Cr

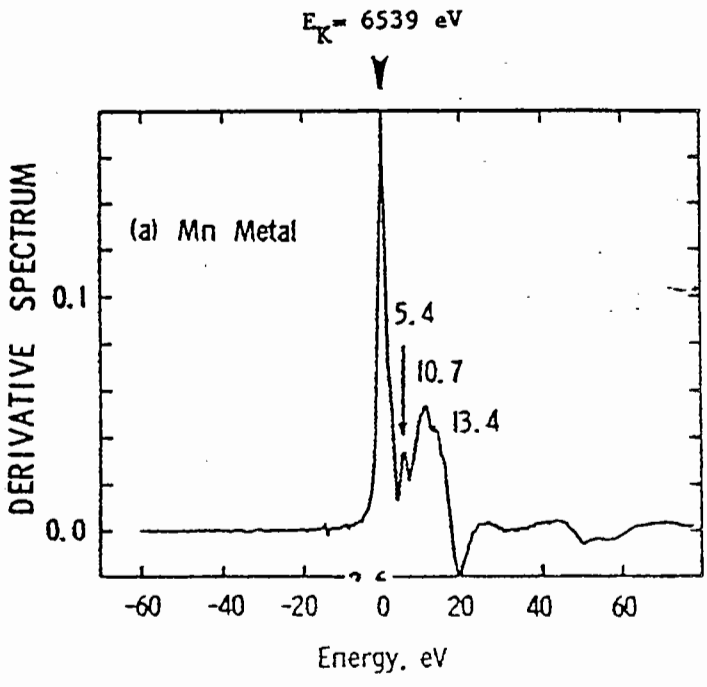

E_K = 5989 eV
ABSORPTION , (ln I_0/I)
1.2
0.8
0.4
0.0
-200
0
200
400
600
800
1000
E - E_K, eV


E_K = 5989 eV
NORMALIZED ABSORPTION
(a) Cr Metal
1.2
0.8
0.4
0.0
1.0
5.6
12.1
20.4
31
-60
-40
-20
0
20
40
60
Energy, eV

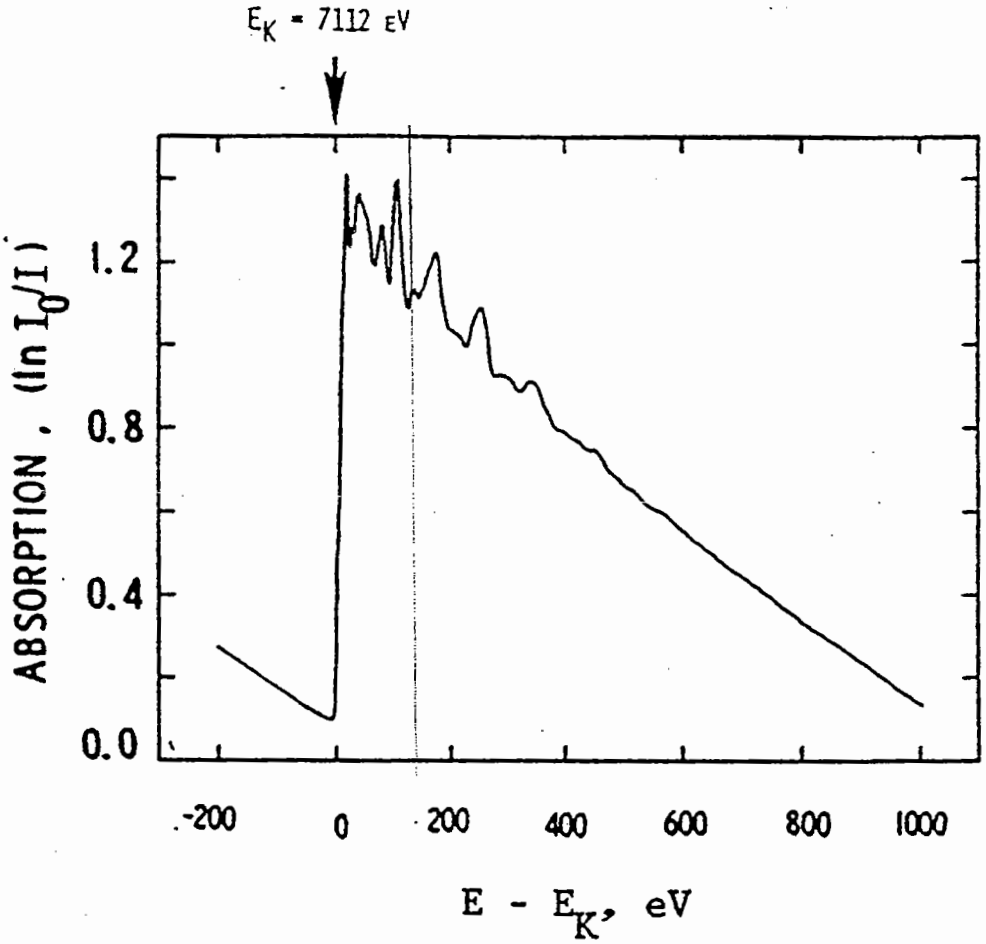

E_K = 5989 eV
DERIVATIVE SPECTRUM
(a) Cr Metal
0.1
0.0
2.1
8.8
17.3
27.7
-60
-40
-20
0
20
40
60
Energy, eV

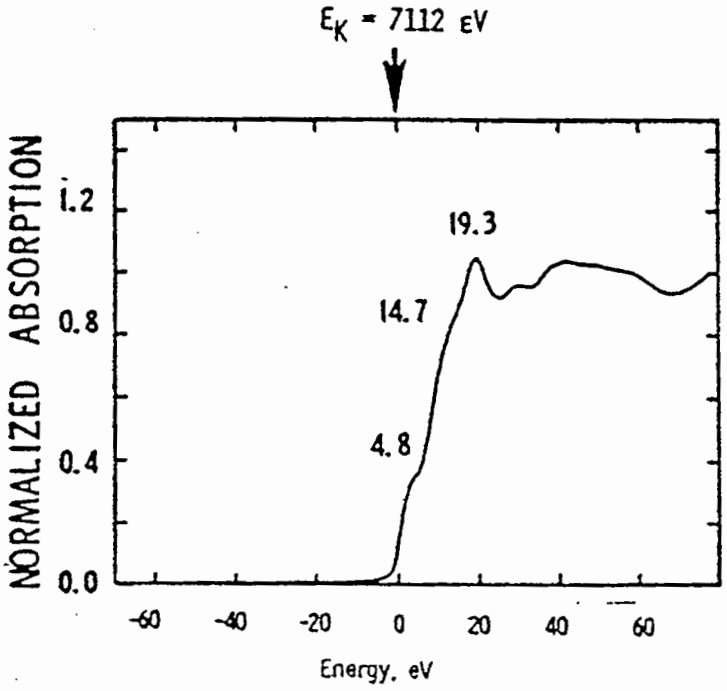

E_K= 6539 eV
ABSORPTION , (ln I_0/I)
1.6
0.8
0.0
-200
0
200
400
600
800
1000
E - E_K, eV

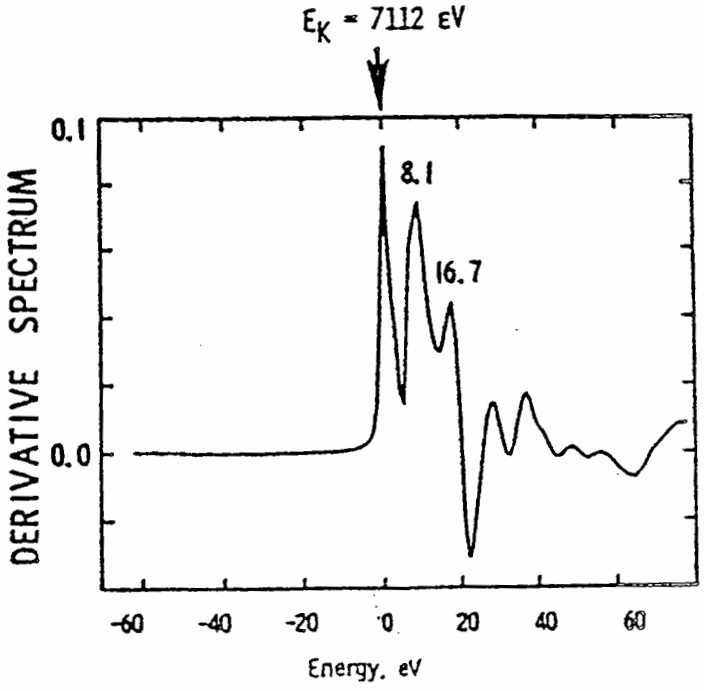

E_K= 6539 eV
NORMALIZED ABSORPTION
(a) Mn Metal
1.2
0.8
0.4
0.0
17.6
10.8
7.2
3.7
-60
-40
-20
0
20
40
60
Energy, eV


E_K= 6539 eV
DERIVATIVE SPECTRUM
(a) Mn Metal
0.1
0.0
5.4
10.7
13.4
-60
-40
-20
0
20
40
60
Energy, eV

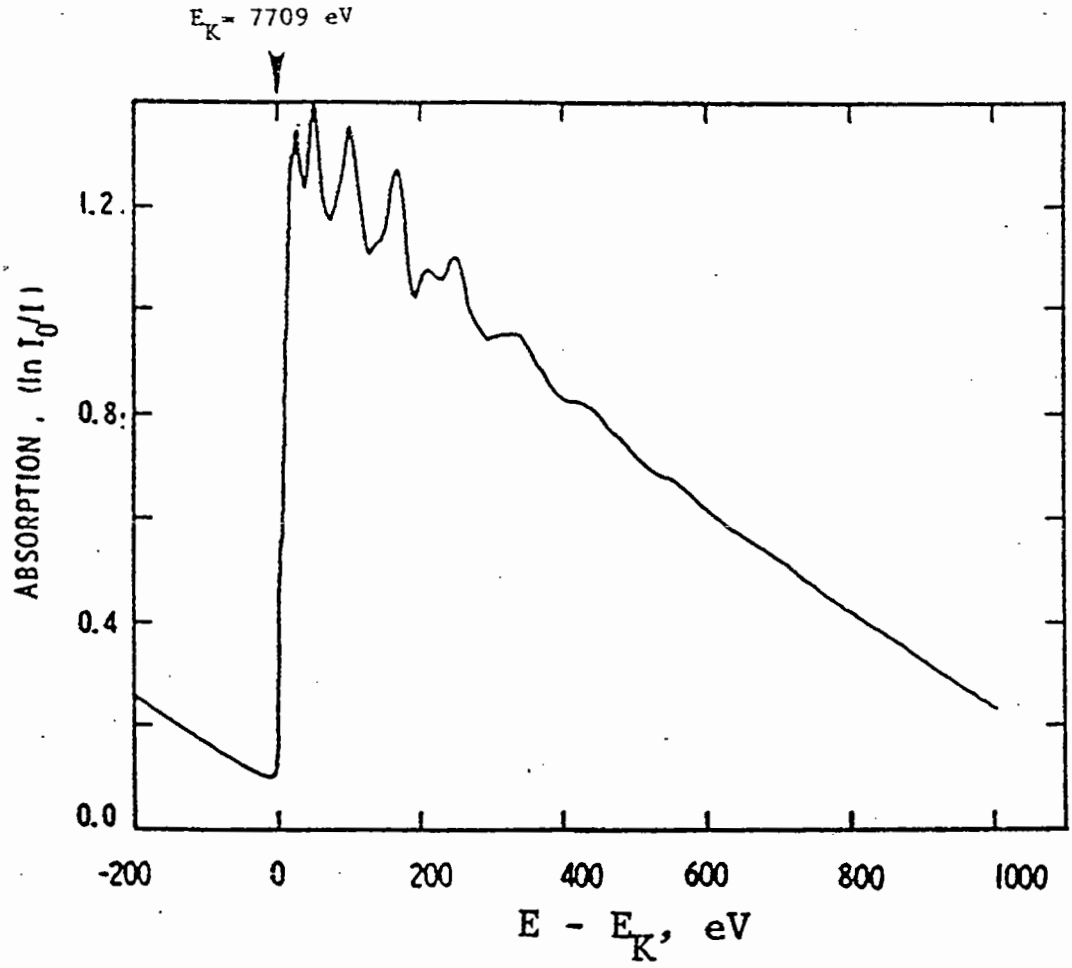
Fe

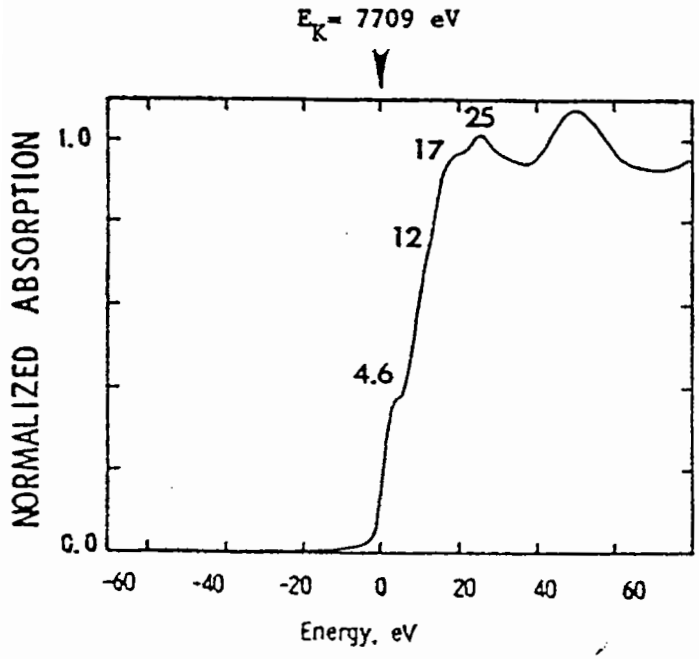

E_K = 7112 eV
ABSORPTION , (ln I_0/I)
1.2
0.8
0.4
0.0
-200
0
200
400
600
800
1000
E - E_K, eV

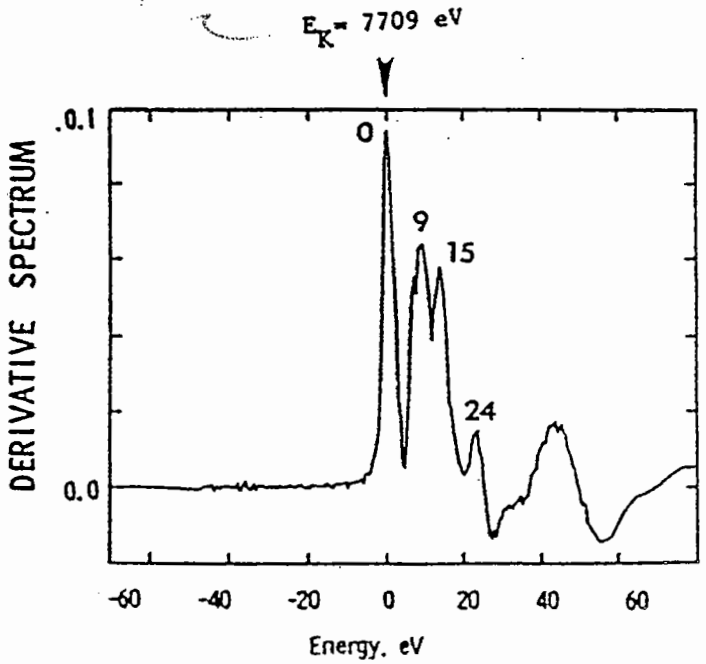

E_K = 7112 eV
NORMALIZED ABSORPTION
1.2
0.8
0.4
0.0
19.3
14.7
4.8
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 7112 eV
DERIVATIVE SPECTRUM
0.1
0.0
8.1
16.7
-60
-40
-20
0
20
40
60
Energy, eV

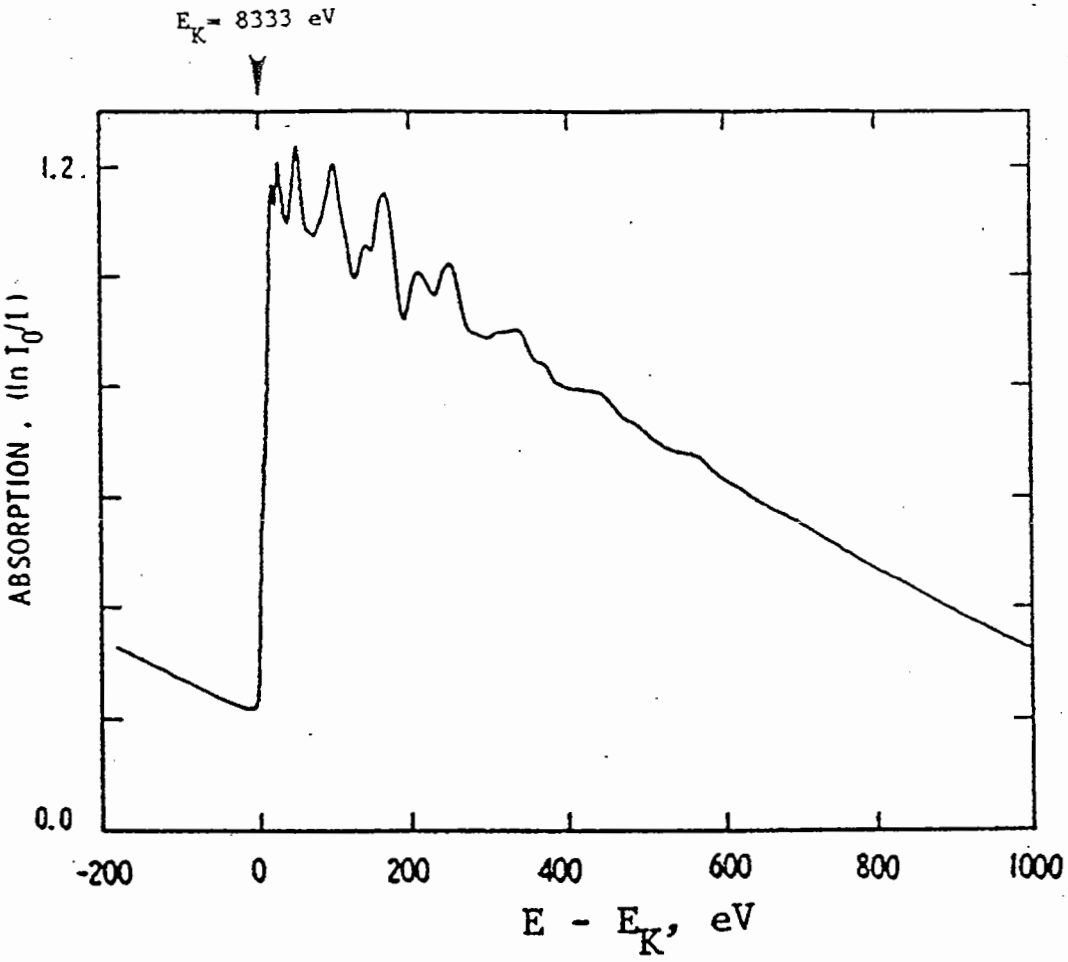
Co

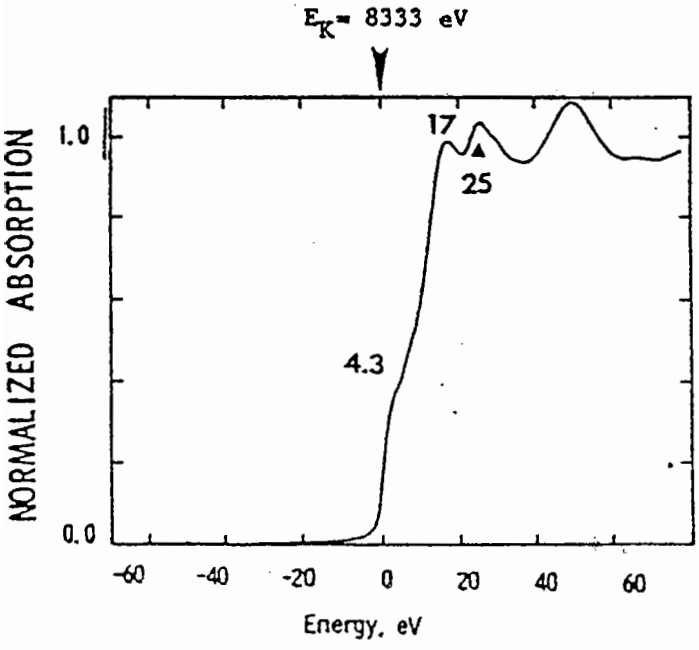

E_K = 7709 eV
ABSORPTION , (ln I_0/I)
1.2
0.8
0.4
0.0
-200
0
200
400
600
800
1000
E - E_K, eV

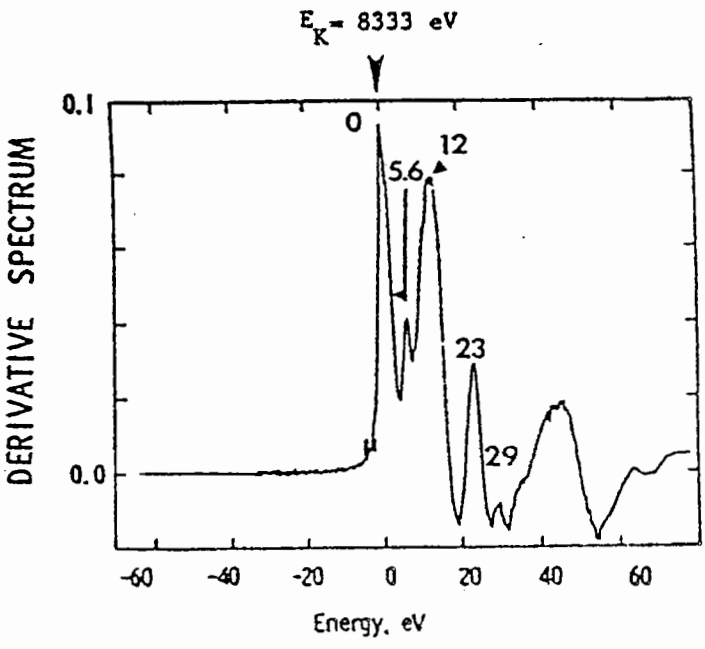

E_K = 7709 eV
NORMALIZED ABSORPTION
1.0
0.0
25
17
12
4.6
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 7709 eV
DERIVATIVE SPECTRUM
.0.1
0.0
0
9
15
24
-60
-40
-20
0
20
40
60
Energy, eV

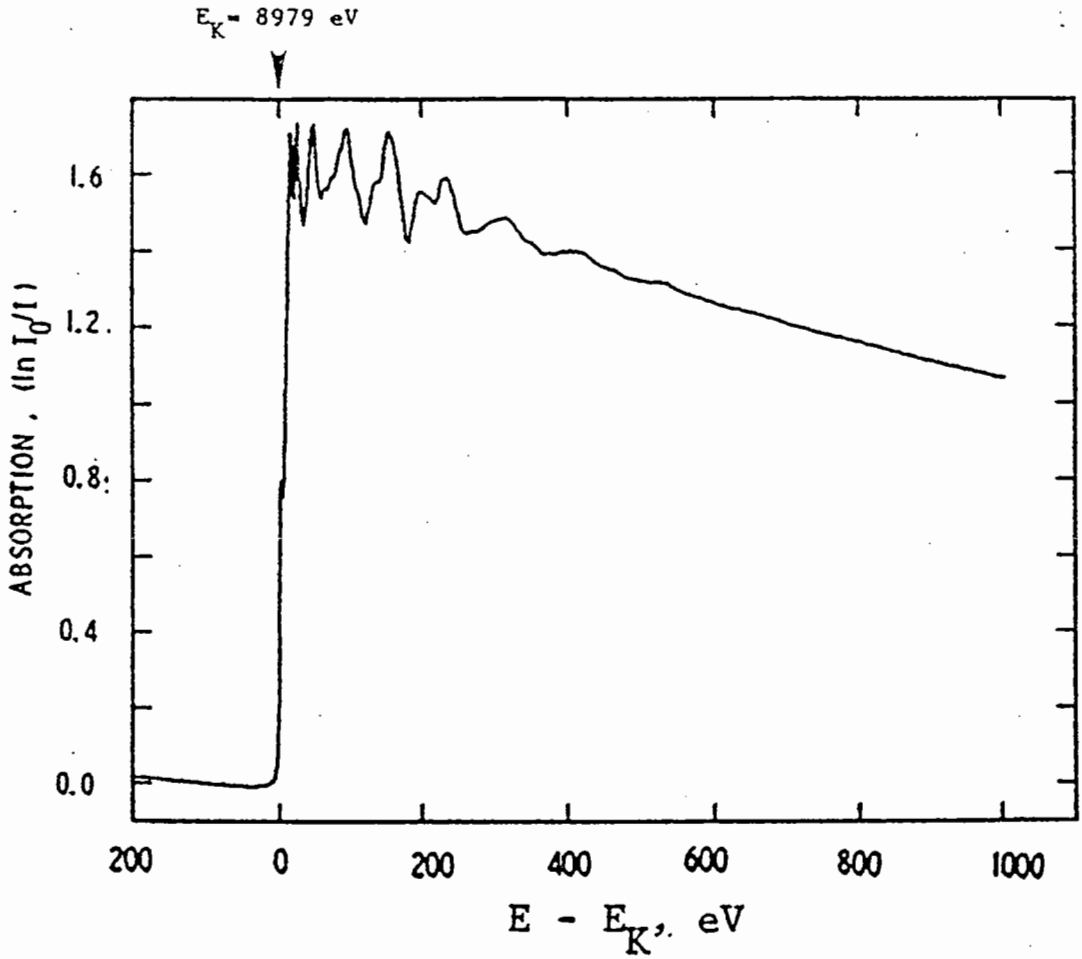
Ni

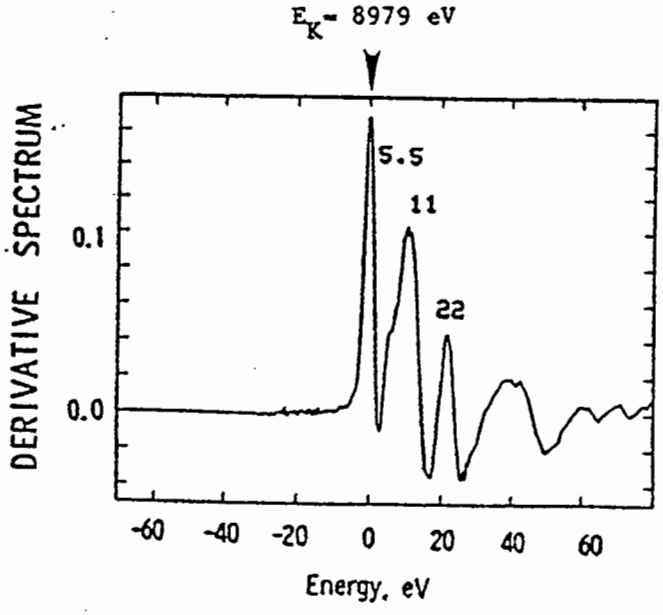

E_K = 8333 eV
1.2
0.0
ABSORPTION , (ln I_0/I)
-200
0
200
400
600
800
1000
E - E_K, eV

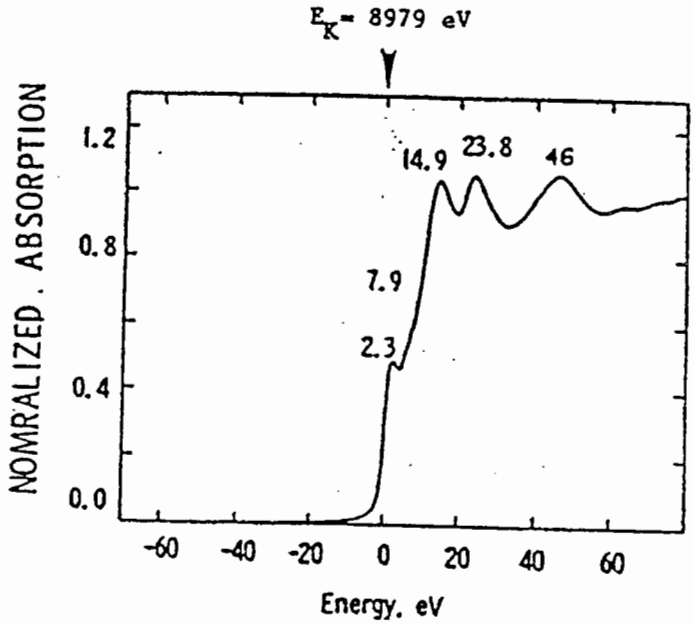

E_K = 8333 eV
1.0
0.0
NORMALIZED ABSORPTION
17
25
4.3
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 8333 eV
0.1
0.0
DERIVATIVE SPECTRUM
0
5.6
12
23
29
-60
-40
-20
0
20
40
60
Energy, eV

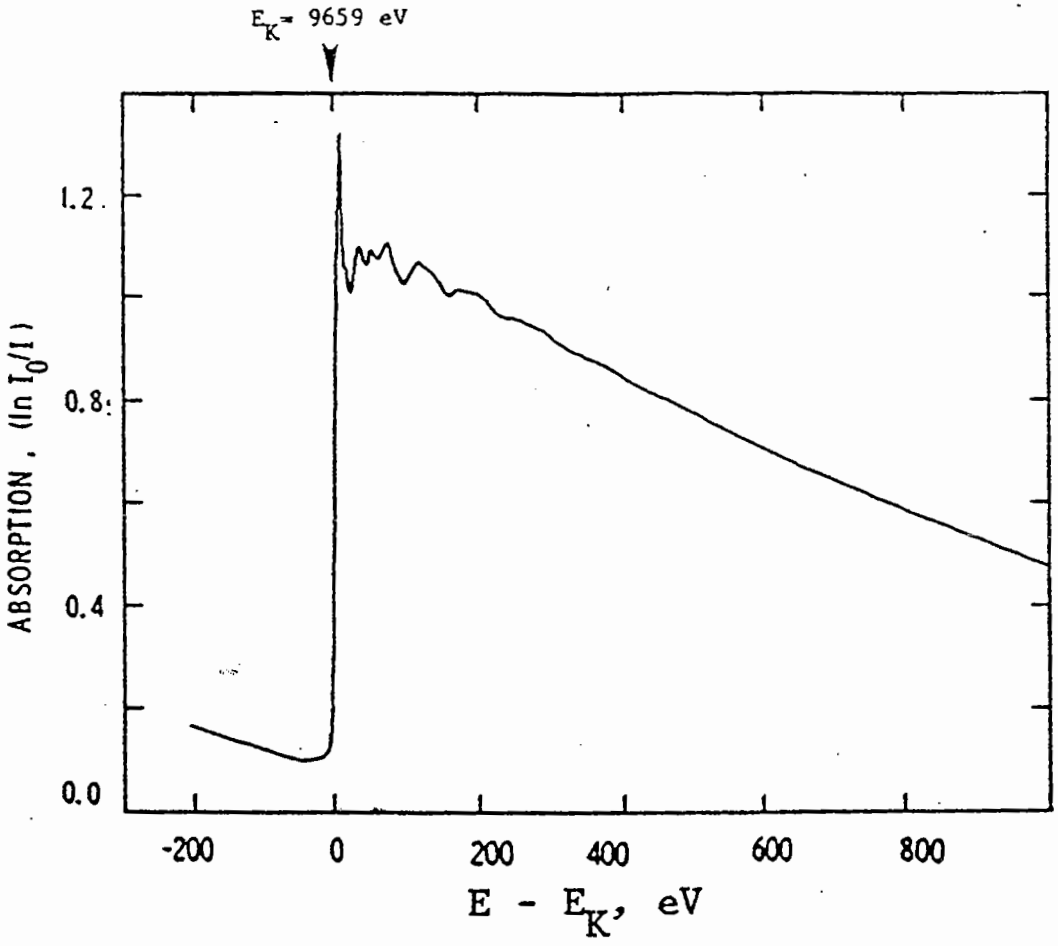
Cu

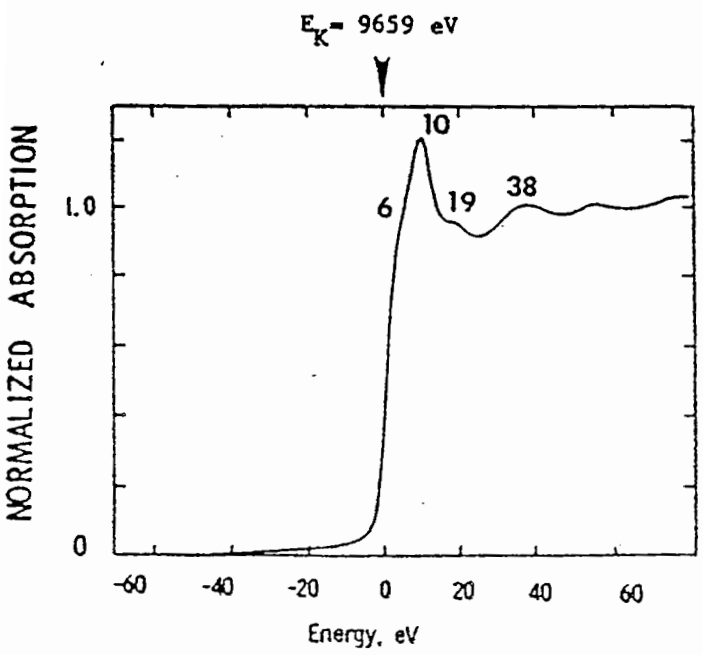

E_K = 8979 eV
ABSORPTION , (ln I_0/I)
1.6
1.2
0.8
0.4
0.0
200
0
200
400
600
800
1000
E - E_K, eV

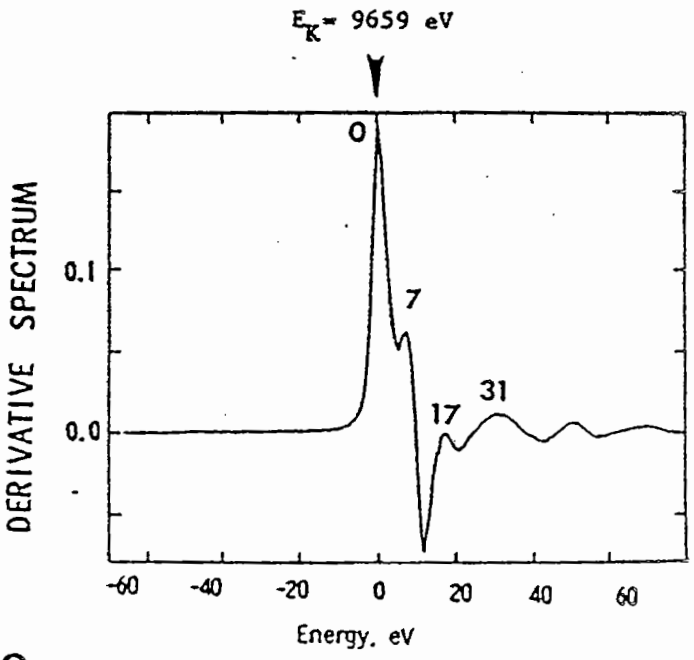

E_K = 8979 eV
DERIVATIVE SPECTRUM
0.1
0.0
5.5
11
22
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 8979 eV
NORMALIZED . ABSORPTION
1.2
0.8
0.4
0.0
14.9
23.8
46
7.9
2.3
-60
-40
-20
0
20
40
60
Energy, eV

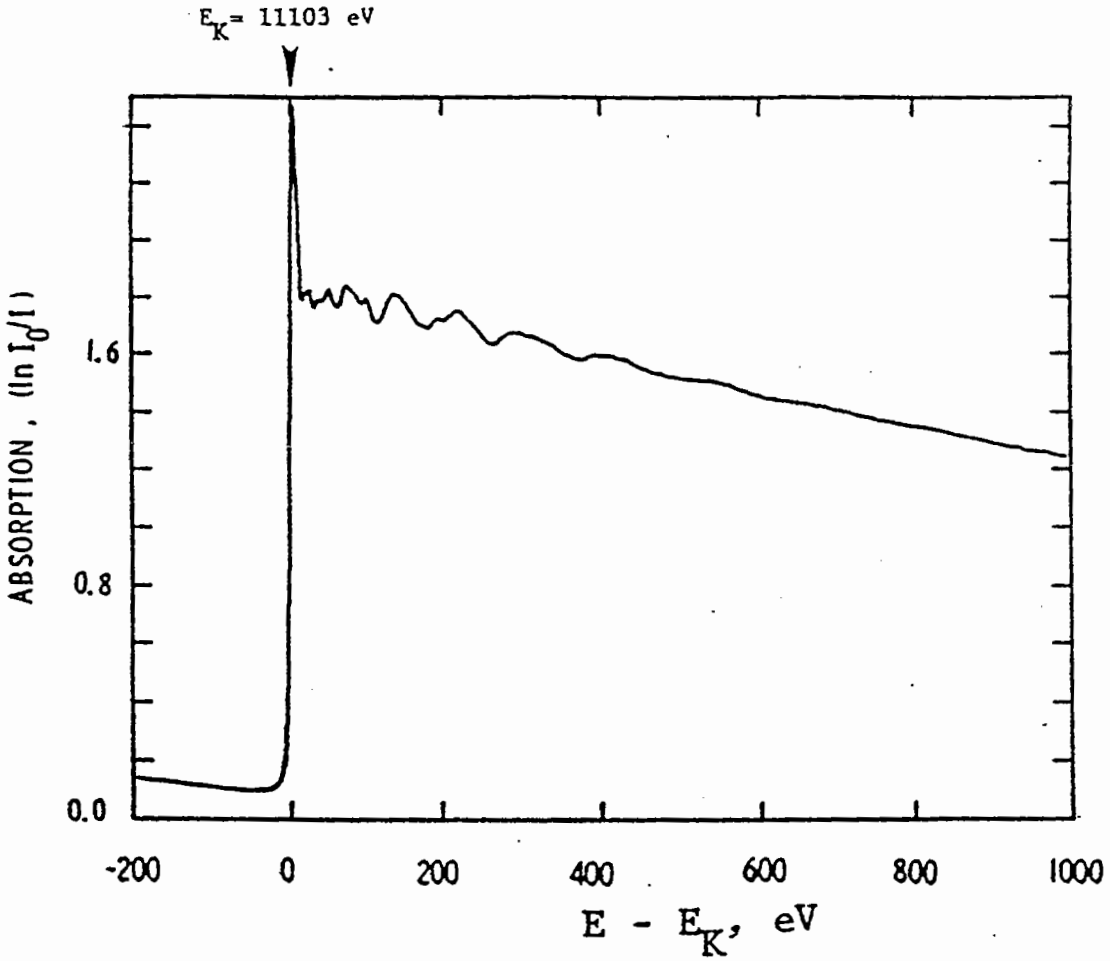
Zn

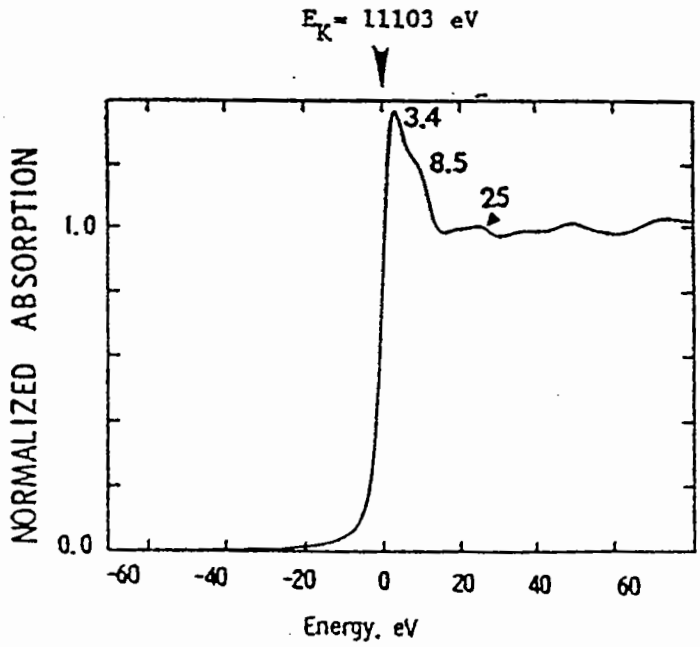

E_K = 9659 eV
ABSORPTION , (ln I_0/I)
1.2
0.8
0.4
0.0
-200
0
200
400
600
800
E - E_K, eV

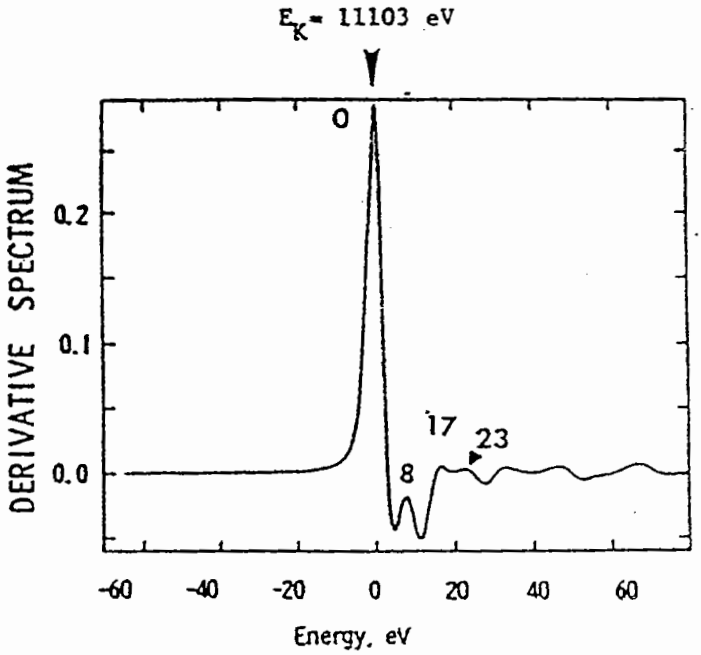

E_K = 9659 eV
NORMALIZED ABSORPTION
1.0
0
10
6
19
38
-60
-40
-20
0
20
40
60
Energy, eV

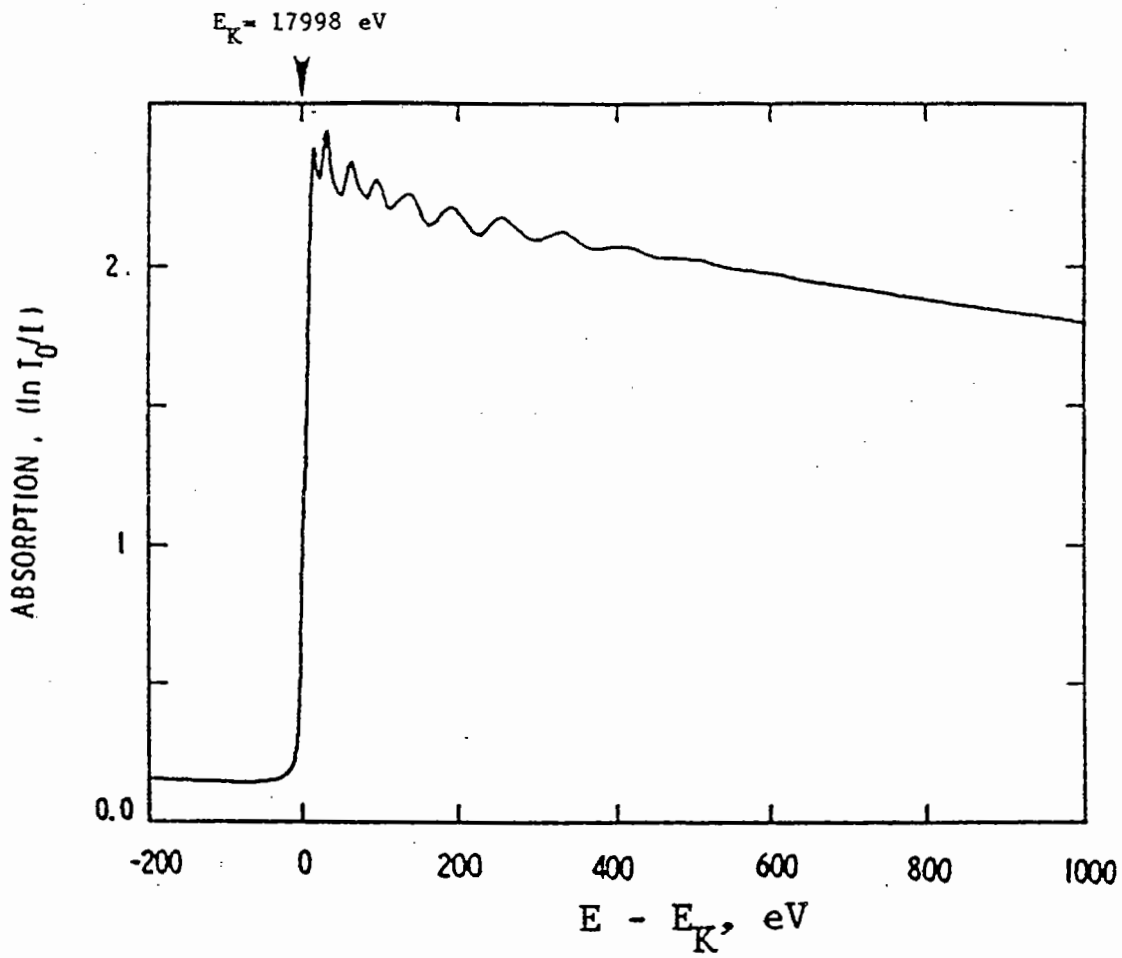

E_K = 9659 eV
DERIVATIVE SPECTRUM
0.1
0.0
0
7
17
31
-60
-40
-20
0
20
40
60
Energy, eV

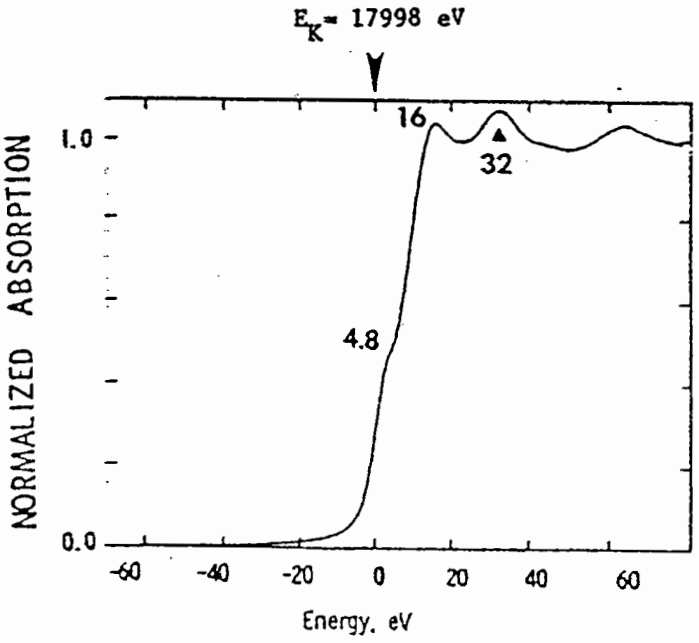
Ge

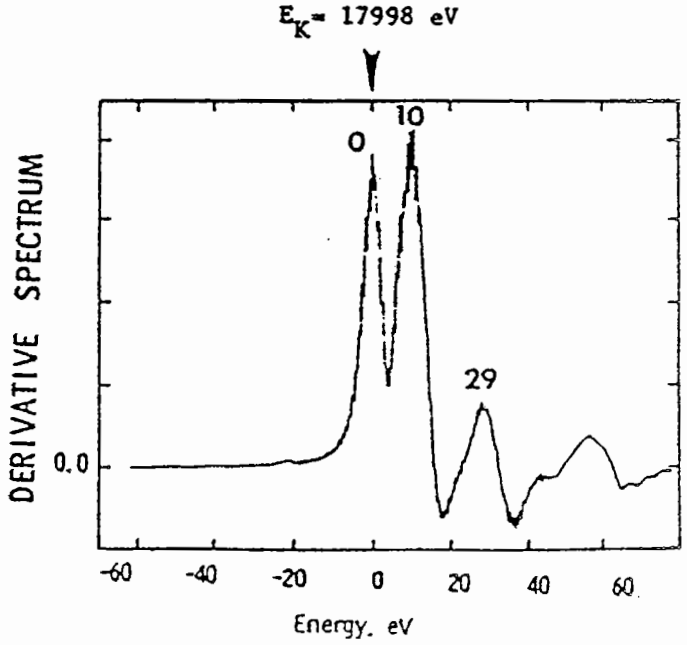

E_K = 11103 eV
ABSORPTION , (ln I_0/I)
1.6
0.8
0.0
-200
0
200
400
600
800
1000
E - E_K, eV


E_K = 11103 eV
NORMALIZED ABSORPTION
1.0
0.0
3.4
8.5
25
-60
-40
-20
0
20
40
60
Energy, eV

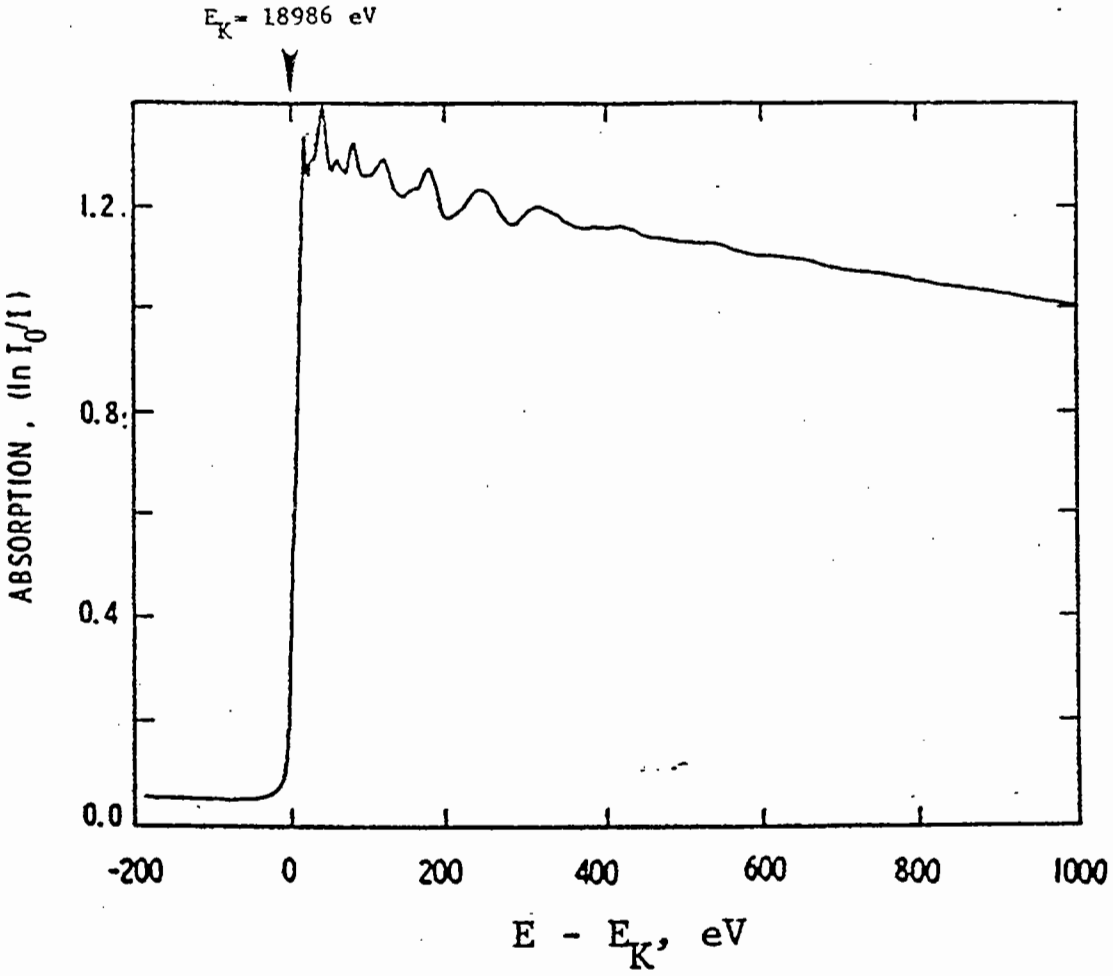

E_K = 11103 eV
DERIVATIVE SPECTRUM
0.2
0.1
0.0
0
17
23
8
-60
-40
-20
0
20
40
60
Energy, eV

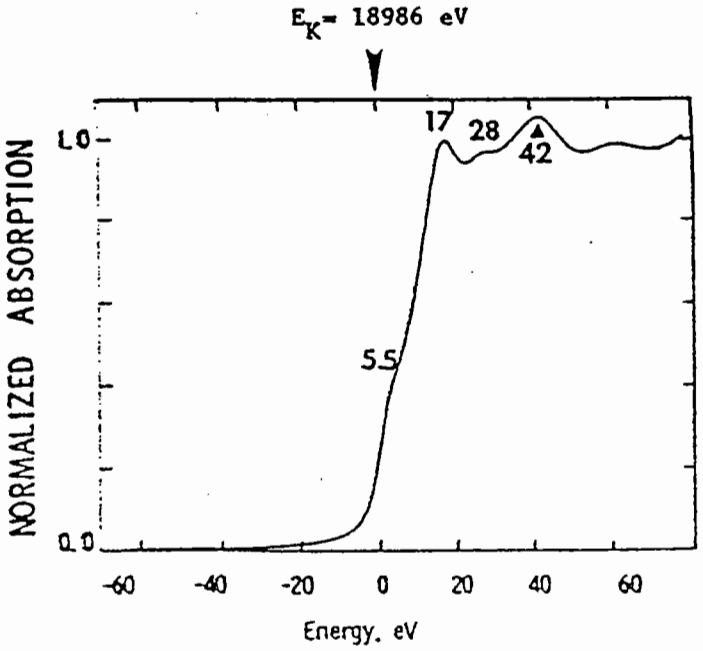

E_K = 17998 eV
ABSORPTION , (ln I_0/I)
2.
1
0.0
-200
0
200
400
600
800
1000
E - E_K, eV

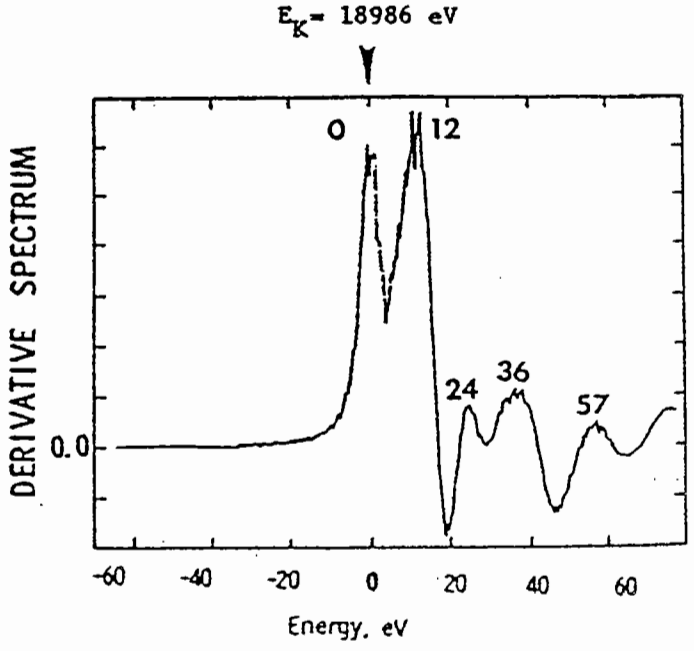

E_K = 17998 eV
NORMALIZED ABSORPTION
1.0
0.0
16
32
4.8
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 17998 eV
DERIVATIVE SPECTRUM
0.0
0
10
29
-60
-40
-20
0
20
40
60
Energy, eV

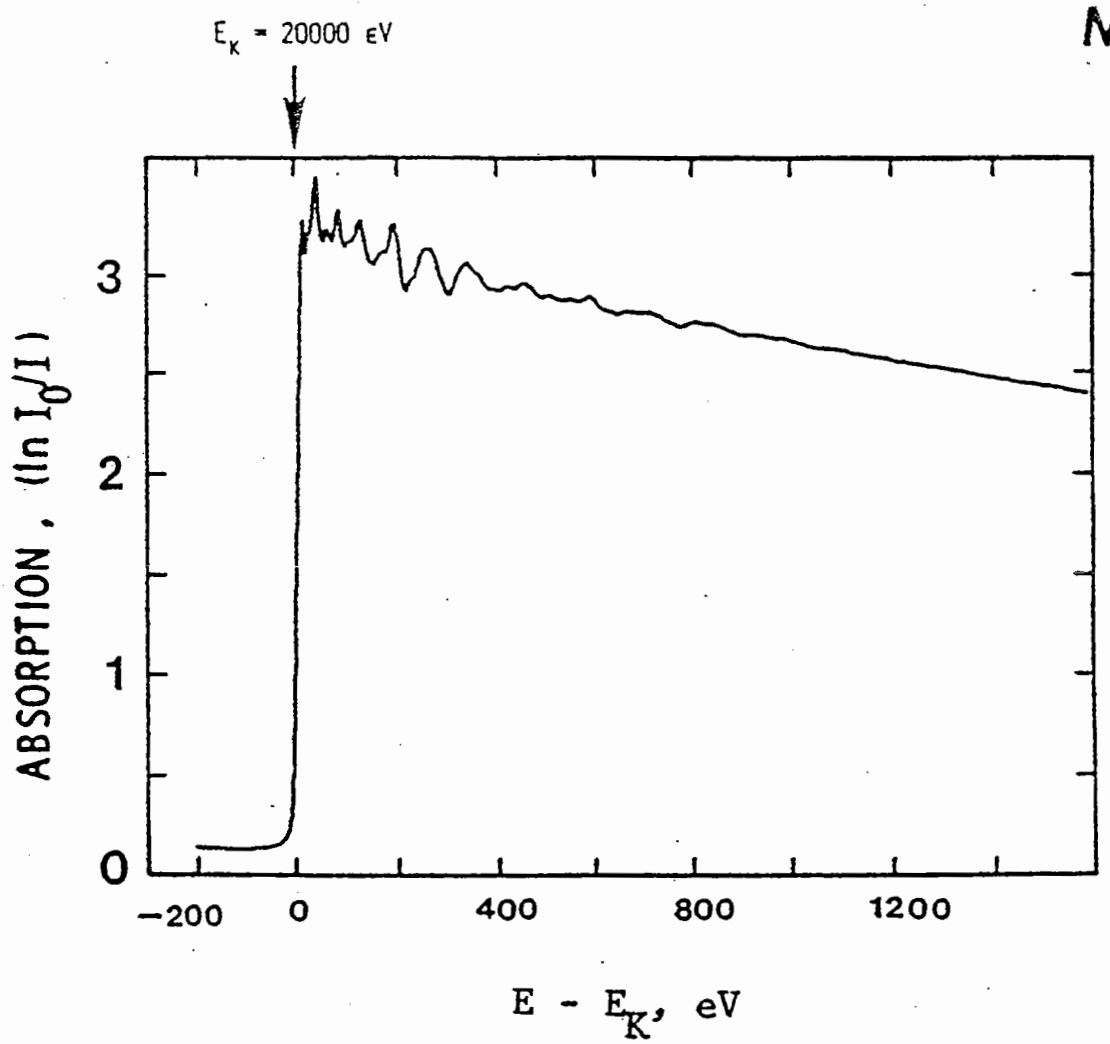
Nb

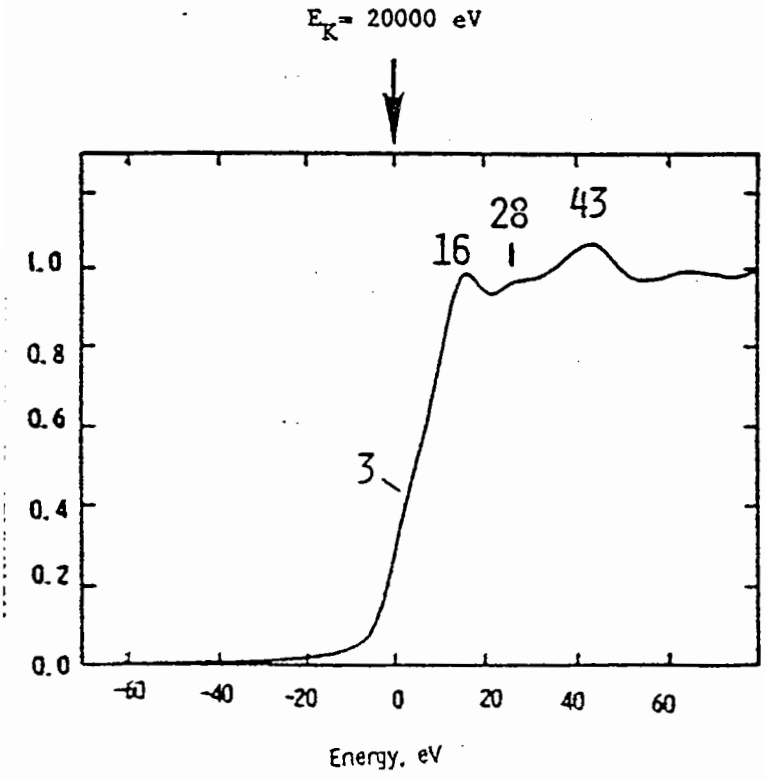

E_K = 18986 eV
ABSORPTION , (ln I_0/I)
1.2
0.8
0.4
0.0
-200
0
200
400
600
800
1000
E - E_K, eV

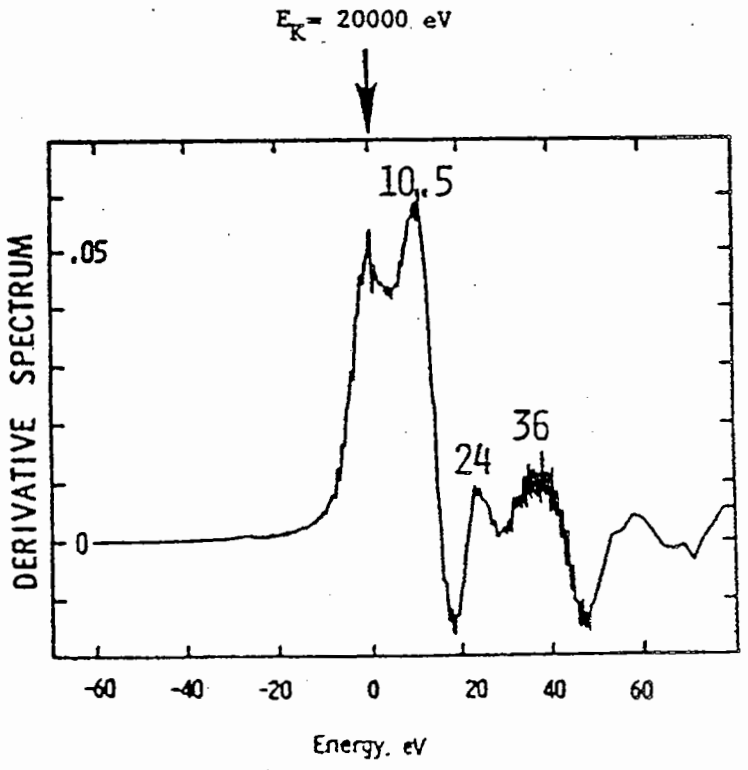

E_K = 18986 eV
NORMALIZED ABSORPTION
1.0
0.0
17
28
42
5.5
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 18986 eV
DERIVATIVE SPECTRUM
0.0
0
12
24
36
57
-60
-40
-20
0
20
40
60
Energy, eV

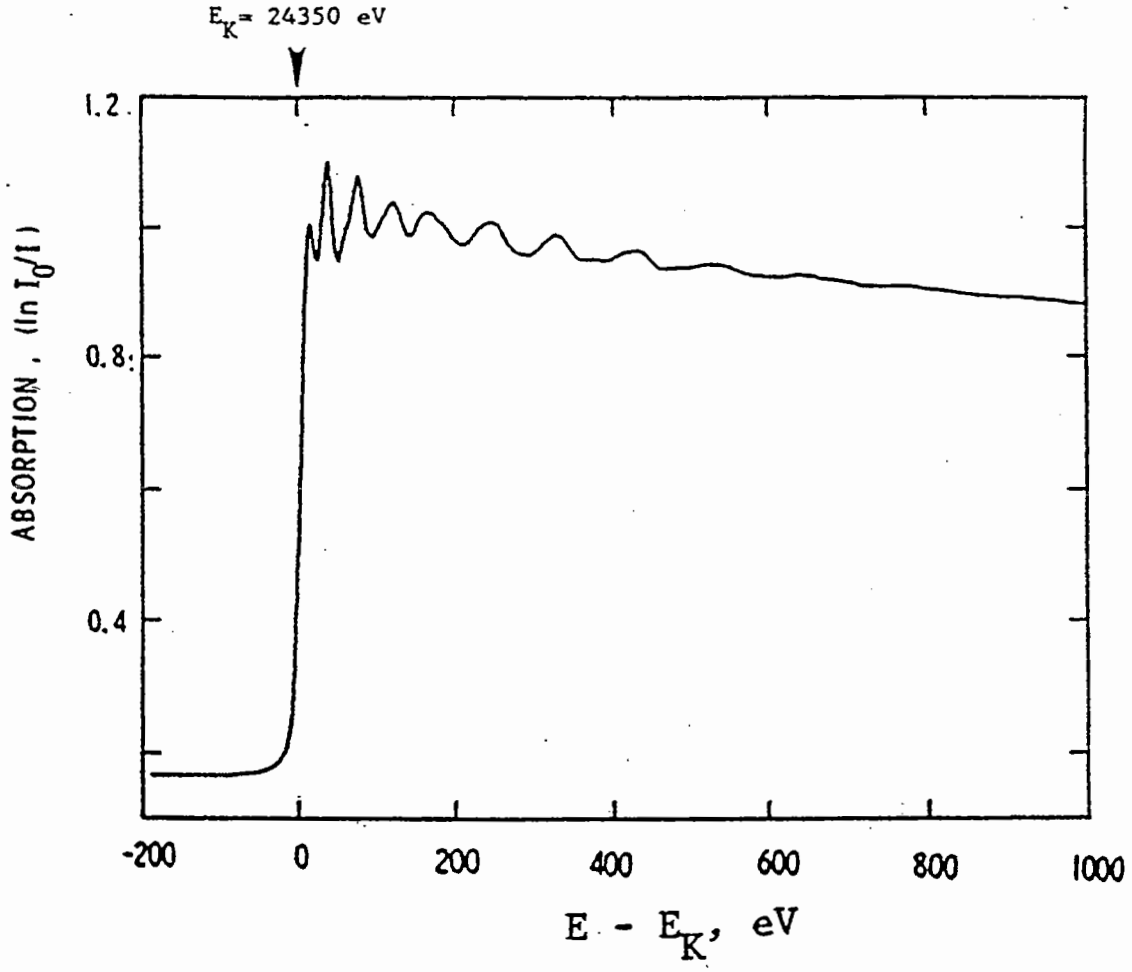
Mo

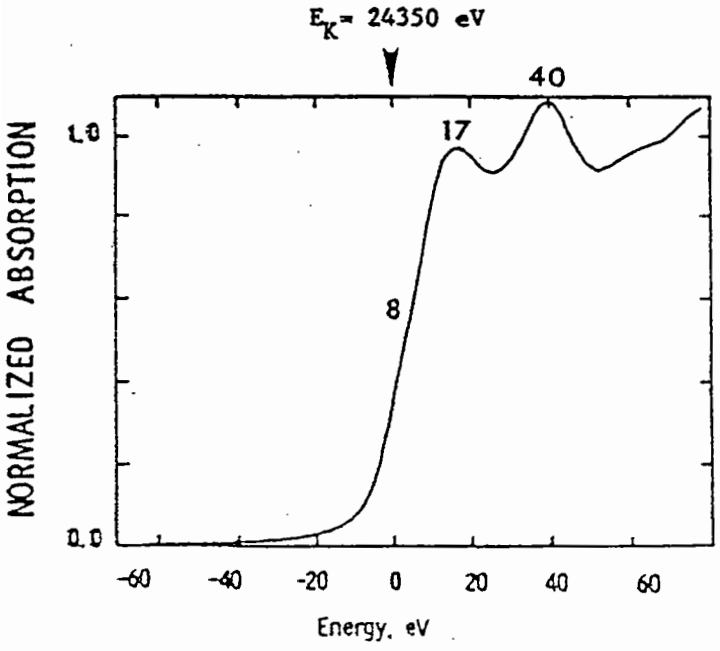

E_K = 20000 eV
ABSORPTION , (ln I_0/I)
0
1
2
3
−200
0
400
800
1200
E - E_K, eV

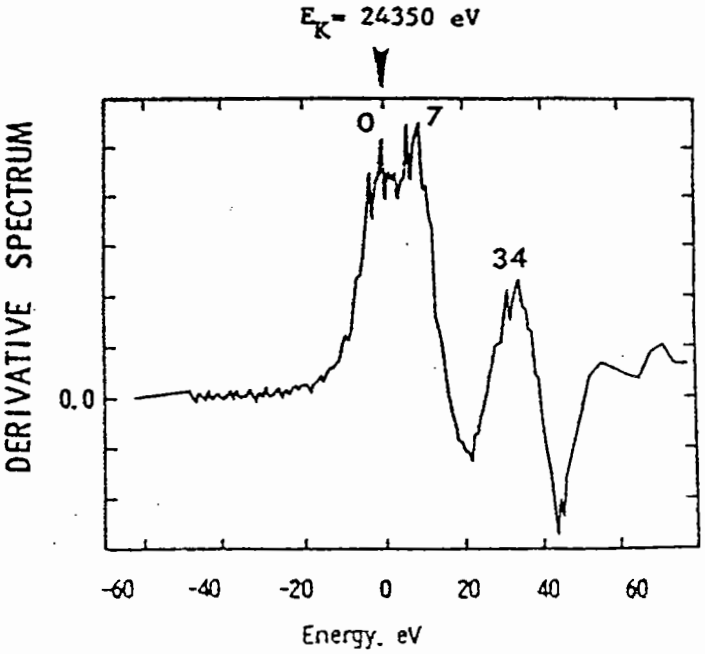

E_K = 20000 eV
0.0
0.2
0.4
0.6
0.8
1.0
3
16
28
43
−60
−40
−20
0
20
40
60
Energy, eV


E_K = 20000 eV
DERIVATIVE SPECTRUM
.05
0
10.5
24
36
−60
−40
−20
0
20
40
60
Energy, eV

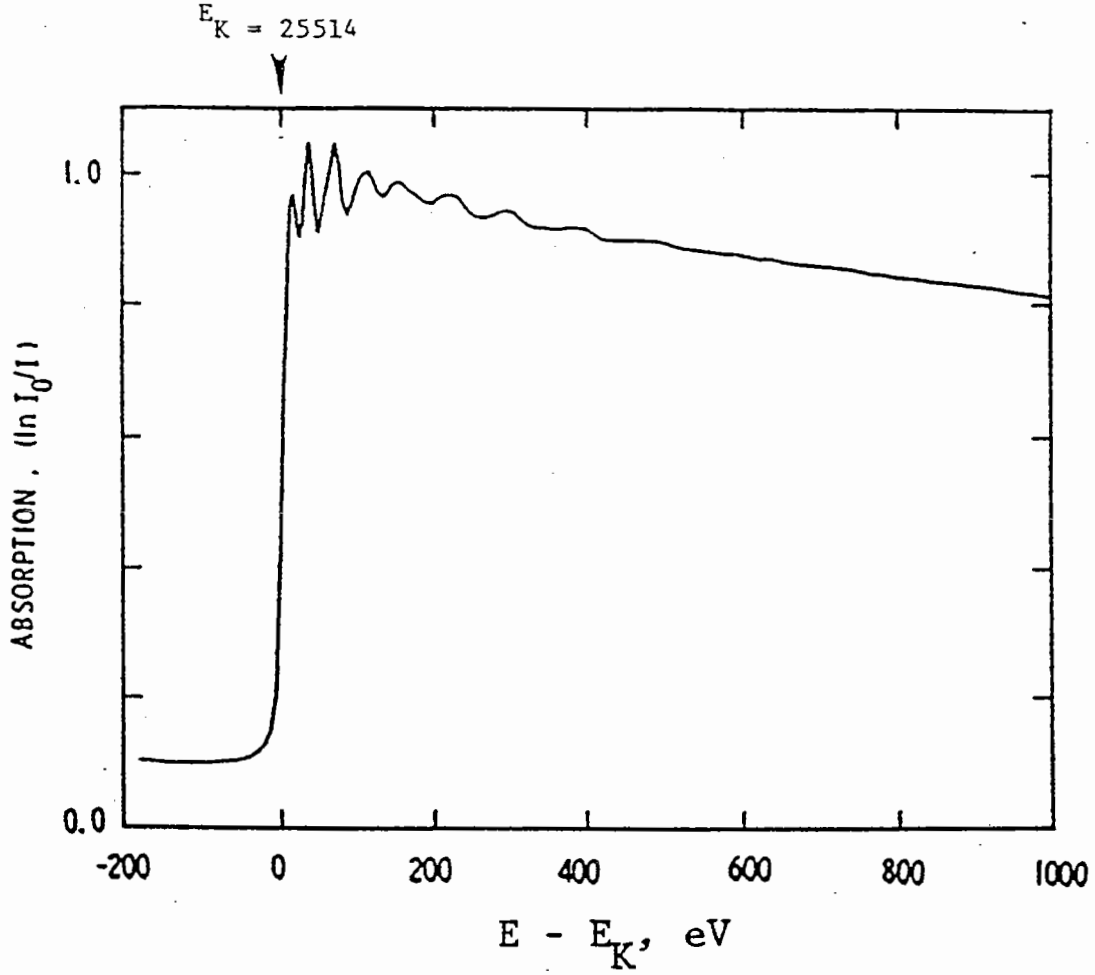
Pd

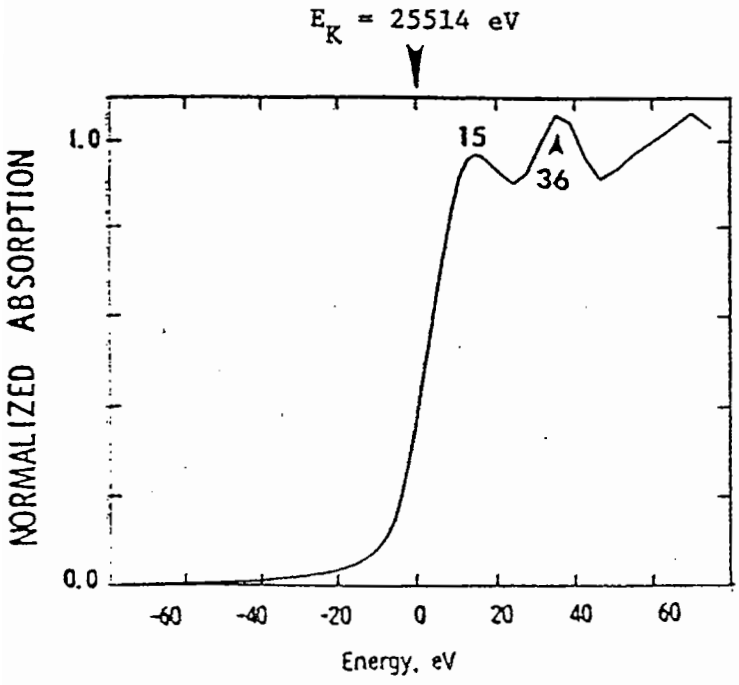

E_K= 24350 eV
1.2
0.8
0.4
ABSORPTION , (ln I_0/I)
-200
0
200
400
600
800
1000
E - E_K, eV

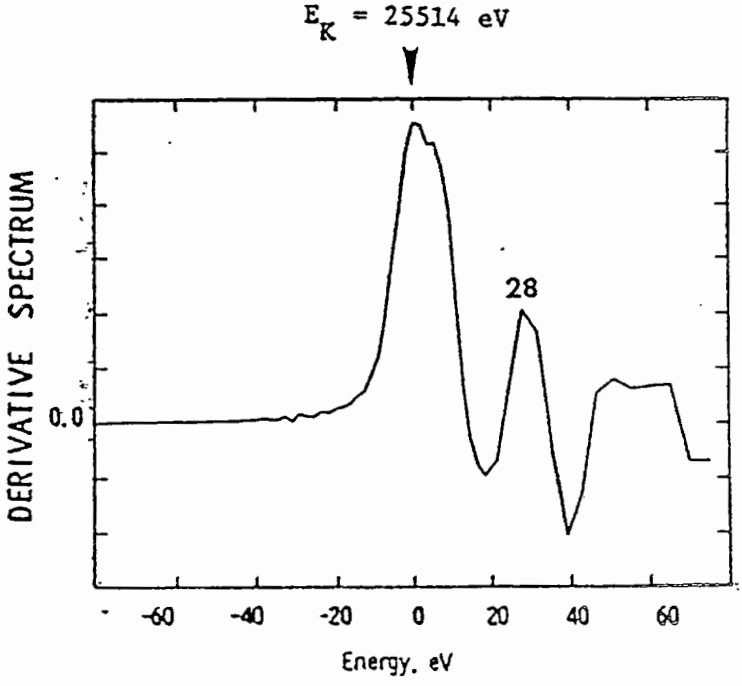

E_K= 24350 eV
40
17
8
1.0
0.0
NORMALIZED ABSORPTION
-60
-40
-20
0
20
40
60
Energy, eV


E_K= 24350 eV
0
7
34
0.0
DERIVATIVE SPECTRUM
-60
-40
-20
0
20
40
60
Energy, eV

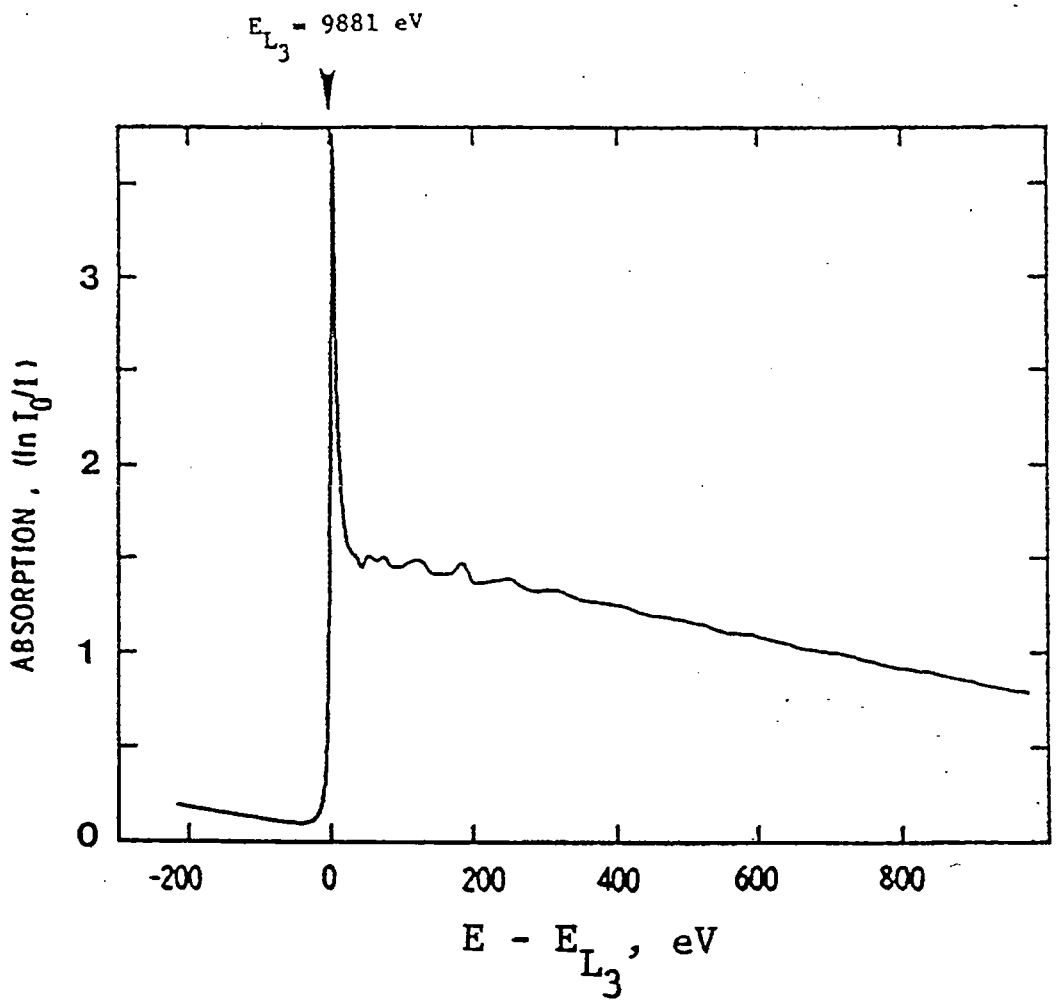
Ag

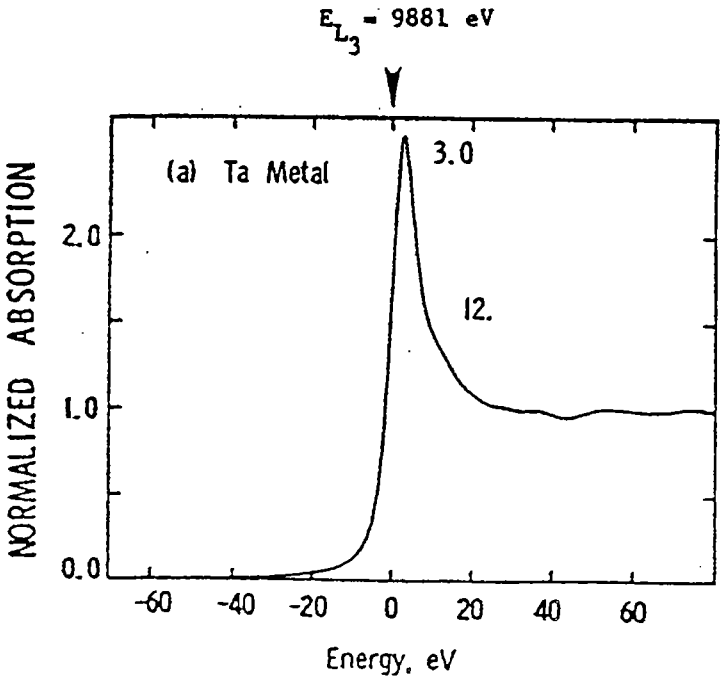

E_K = 25514
1.0
0.0
ABSORPTION , (ln I_0/I)
-200
0
200
400
600
800
1000
E - E_K, eV

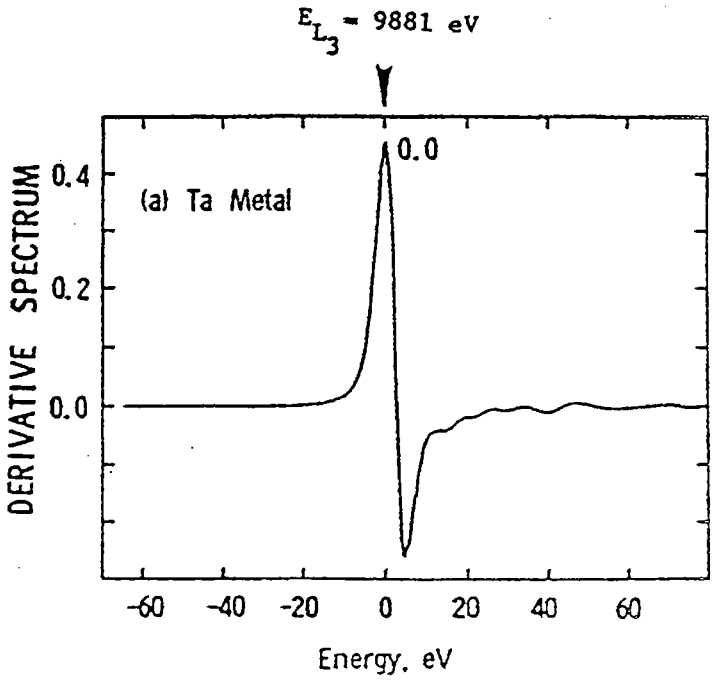

E_K = 25514 eV
NORMALIZED ABSORPTION
1.0
0.0
15
36
-60
-40
-20
0
20
40
60
Energy, eV


E_K = 25514 eV
DERIVATIVE SPECTRUM
0.0
28
-60
-40
-20
0
20
40
60
Energy, eV

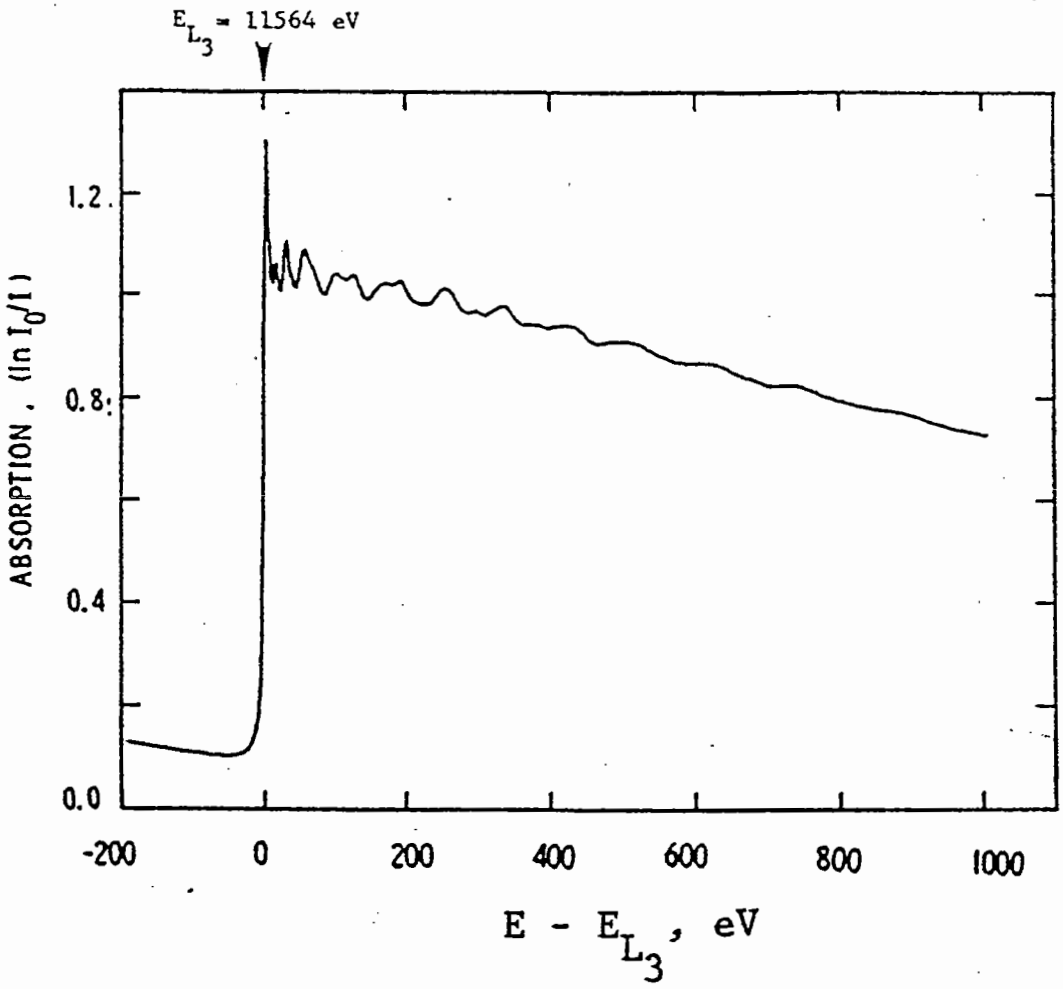
Ta

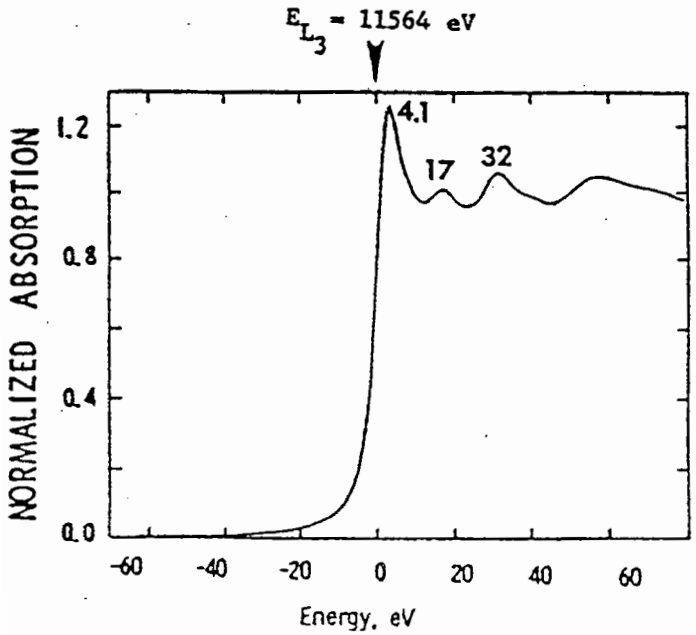

E_{L_3} = 9881 eV
ABSORPTION , (ln I_0/I)
0
1
2
3
-200
0
200
400
600
800
E - E_{L_3}, eV

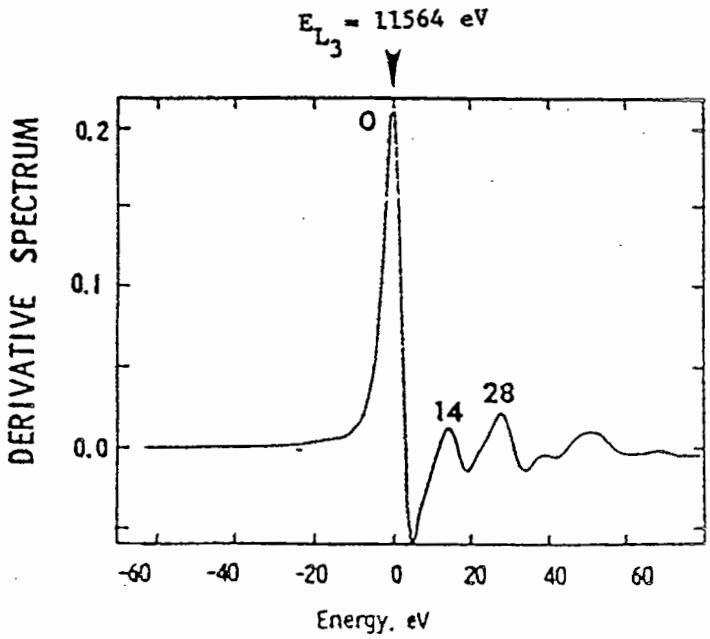

E_{L_3} = 9881 eV
(a) Ta Metal
3.0
12.
NORMALIZED ABSORPTION
0.0
1.0
2.0
-60
-40
-20
0
20
40
60
Energy, eV


E_{L_3} = 9881 eV
(a) Ta Metal
0.0
DERIVATIVE SPECTRUM
0.0
0.2
0.4
-60
-40
-20
0
20
40
60
Energy, eV

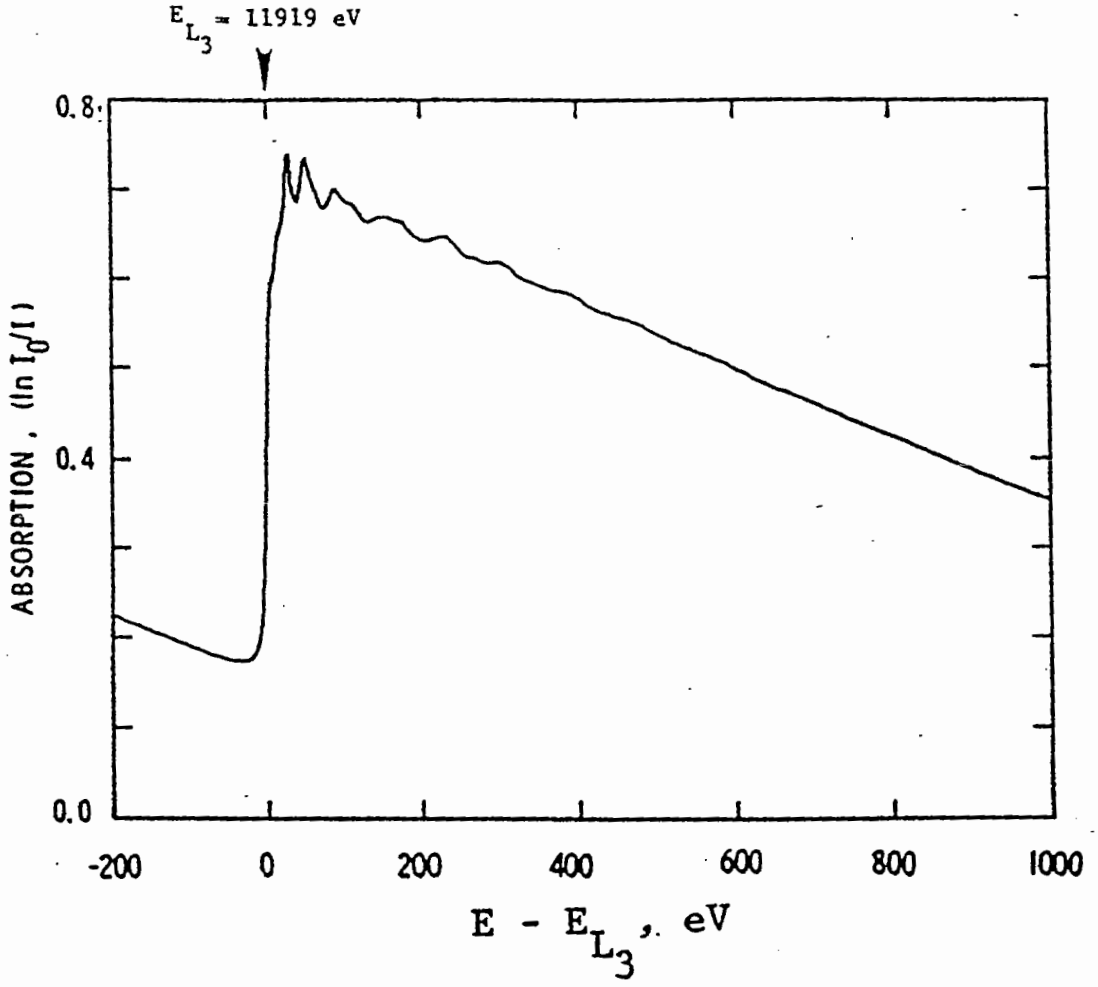
Pt

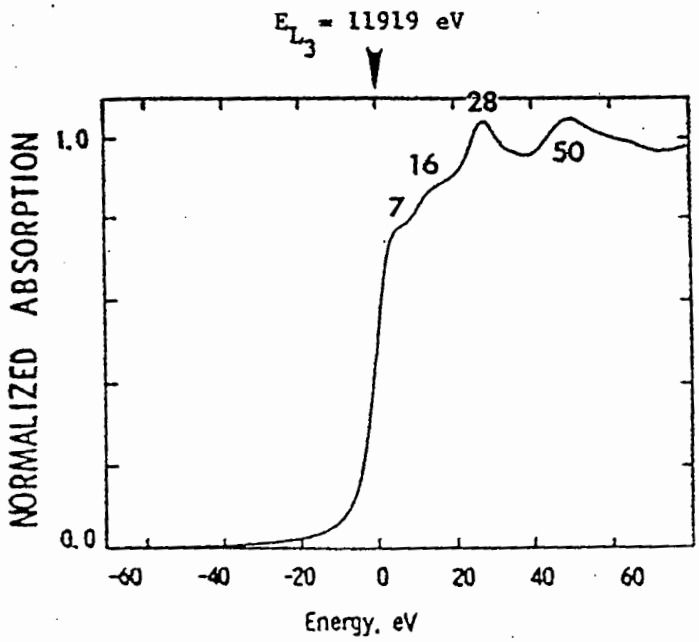

E_{L_3} = 11564 eV
ABSORPTION , (ln I_0/I)
1.2
0.8
0.4
0.0
-200
0
200
400
600
800
1000
E - E_{L_3}, eV

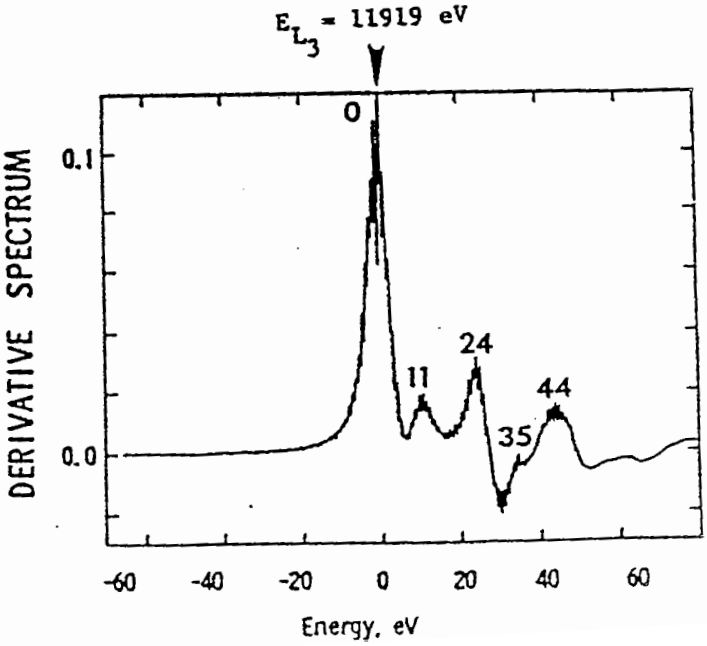

E_{L_3} = 11564 eV
NORMALIZED ABSORPTION
1.2
0.8
0.4
0.0
4.1
17
32
-60
-40
-20
0
20
40
60
Energy, eV

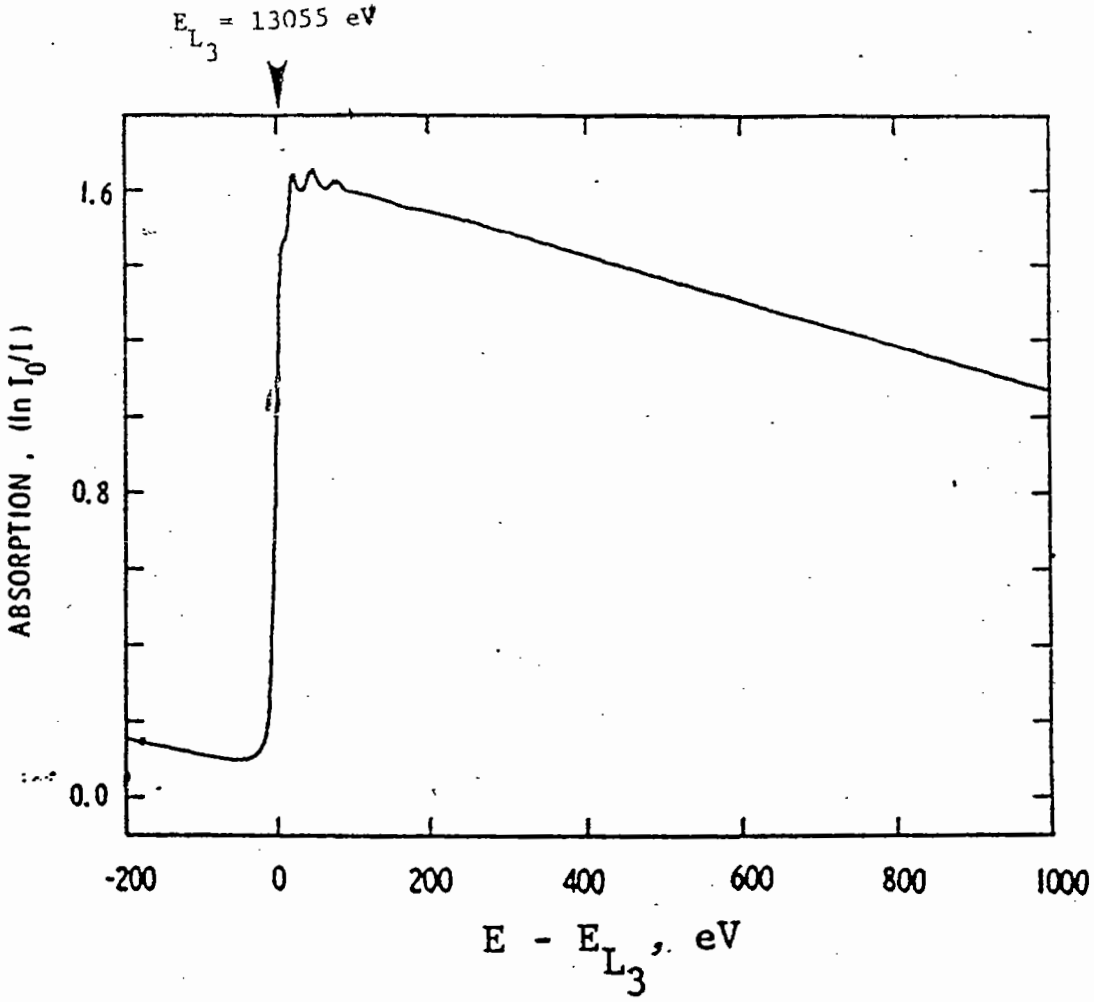

E_{L_3} = 11564 eV
DERIVATIVE SPECTRUM
0.2
0.1
0.0
0
14
28
-60
-40
-20
0
20
40
60
Energy, eV

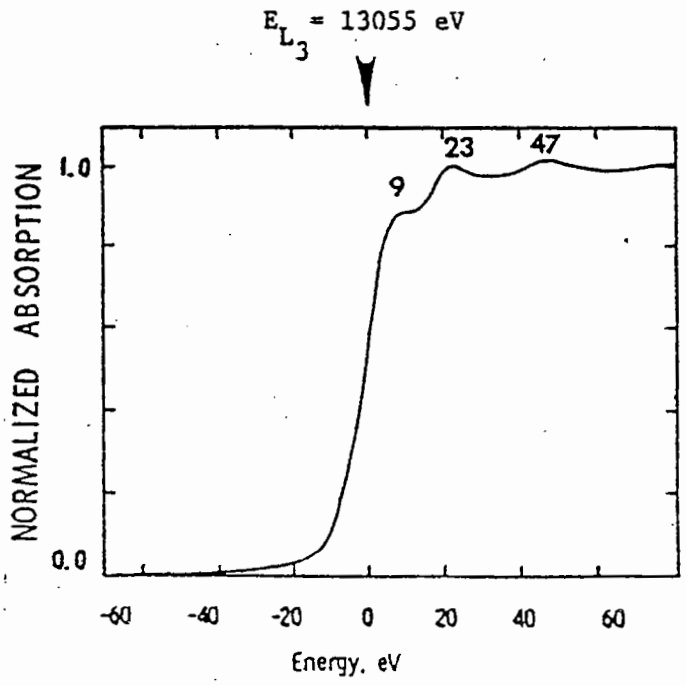
Au

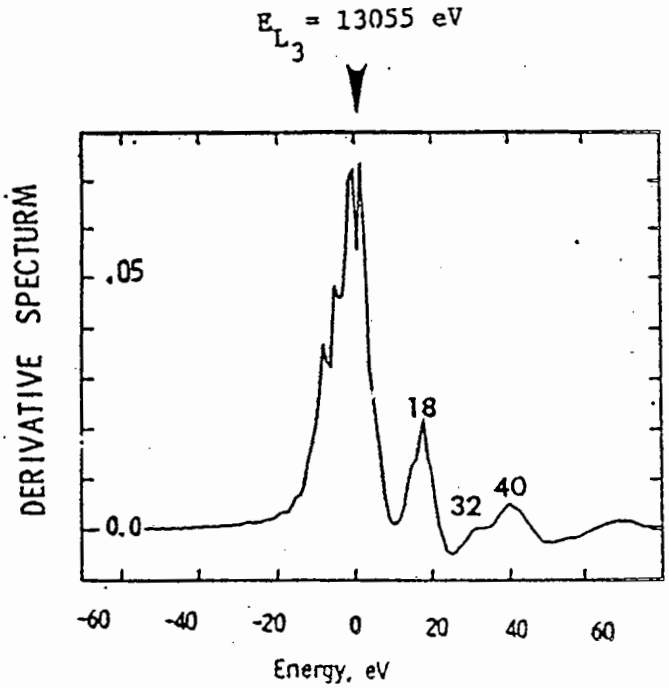

E_{L_3} = 11919 eV
0.8
0.4
0.0
ABSORPTION , (ln I_0/I)
-200
0
200
400
600
800
1000
E - E_{L_3}, eV


E_{L_3} = 11919 eV
NORMALIZED ABSORPTION
1.0
0.0
28
16
7
50
-60
-40
-20
0
20
40
60
Energy, eV


E_{L_3} = 11919 eV
DERIVATIVE SPECTRUM
0.1
0.0
0
11
24
35
44
-60
-40
-20
0
20
40
60
Energy, eV


E L3 = 13055 eV
ABSORPTION . (ln I0/I)
1.6
0.8
0.0
-200
0
200
400
600
800
1000
E - EL3, eV


E L3 = 13055 eV
NORMALIZED ABSORPTION
1.0
0.0
9
23
47
-60
-40
-20
0
20
40
60
Energy, eV


E L3 = 13055 eV
DERIVATIVE SPECTURM
.05
0.0
18
32
40
-60
-40
-20
0
20
40
60
Energy, eV