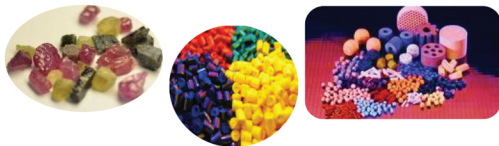


Research Application

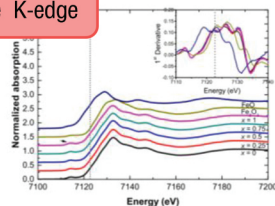
- **Gems, Mineral and Archaeology:**
Determine coloring agents and phases in materials.
- **Biological and Medical Sciences:**
Examine transition metals in soil, water, or plants.
- **Catalysts:** Study of oxidation states, coordination numbers, bond lengths, neighboring atoms, and chemical structures of central atoms.
- **Ceramics and Polymer:** Study the impurities in polymeric structure, improve product quality, and develop new products.



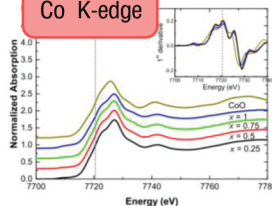
Research Highlights

- Study the effect of the Mg addition on the cation distribution of CoFe_2O_4 nanoparticles

Fe K-edge

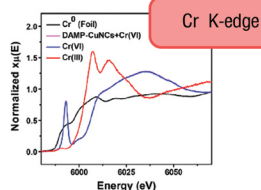


Co K-edge



P. Chirawatkul, J. Alloy. Compd., 697 (2017) 249-256

- Detection of oxidation state of Cr ions after the addition of a trace level of CrO_4^{2-} into low concentration DAMP-CuNCs



Khonkayan, K. et al. Microchim Acta, 184 (2017) 2965-2974.

Measurable Elements at BL1.1W

atomic number	Symbol	name	conventional atomic weight	standard atomic weight
1	H	hydrogen	1.00794	1.00794
2	He	helium	4.002602	4.002602
3	Li	lithium	6.941	6.941
4	Be	beryllium	9.012182	9.012182
5	B	boron	10.811	10.811
6	C	carbon	12.0107	12.0107
7	N	nitrogen	14.00643	14.00643
8	O	oxygen	15.999	15.999
9	F	fluorine	18.9984032	18.9984032
10	Ne	neon	20.1797	20.1797
11	Na	sodium	22.98976928	22.98976928
12	Mg	magnesium	24.304	24.304
13	Al	aluminum	26.9815385	26.9815385
14	Si	silicon	28.0855	28.0855
15	P	phosphorus	30.9737615	30.9737615
16	S	sulfur	32.06	32.06
17	Cl	chlorine	35.45	35.45
18	Ar	argon	39.948	39.948
19	K	potassium	39.0983	39.0983
20	Ca	calcium	40.078	40.078
21	Sc	scandium	44.955912	44.955912
22	Ti	titanium	47.867	47.867
23	V	vanadium	50.9415	50.9415
24	Cr	chromium	51.9961	51.9961
25	Mn	manganese	54.938045	54.938045
26	Fe	iron	55.845	55.845
27	Co	cobalt	58.933195	58.933195
28	Ni	nickel	58.6934	58.6934
29	Cu	copper	63.546	63.546
30	Zn	zinc	65.38	65.38
31	Ga	gallium	69.723	69.723
32	Ge	germanium	72.630	72.630
33	As	arsenic	74.9216	74.9216
34	Se	selenium	78.96	78.96
35	Br	bromine	79.904	79.904
36	Kr	krypton	83.798	83.798
37	Rb	rubidium	85.4678	85.4678
38	Sr	strontium	87.62	87.62
39	Y	yttrium	88.90584	88.90584
40	Zr	zirconium	91.224	91.224
41	Nb	niobium	92.90638	92.90638
42	Mo	molybdenum	95.94	95.94
43	Tc	technetium	98	98
44	Ru	ruthenium	101.07	101.07
45	Rh	rhodium	102.9055	102.9055
46	Pd	palladium	106.42	106.42
47	Ag	silver	107.8682	107.8682
48	Cd	cadmium	112.411	112.411
49	In	indium	114.818	114.818
50	Sn	tin	118.710	118.710
51	Sb	antimony	121.757	121.757
52	Te	tellurium	127.6	127.6
53	I	iodine	126.90547	126.90547
54	Xe	xenon	131.29	131.29
55	Cs	cesium	132.90545196	132.90545196
56	Ba	barium	137.327	137.327
57	La	lanthanum	138.90547	138.90547
58	Ce	cerium	140.12	140.12
59	Pr	praseodymium	140.90765	140.90765
60	Nd	neodymium	144.242	144.242
61	Pm	promethium	145	145
62	Sm	samarium	150.36	150.36
63	Eu	europraseium	151.964	151.964
64	Gd	gadolinium	157.25	157.25
65	Tb	terbium	158.92534	158.92534
66	Dy	dysprosium	162.50015	162.50015
67	Ho	holmium	164.930329	164.930329
68	Er	erbium	167.259	167.259
69	Tm	thulium	168.93032	168.93032
70	Yb	ytterbium	173.0544784	173.0544784
71	Lu	lutetium	174.967	174.967
72	Hf	hafnium	178.49	178.49
73	Ta	tantalum	180.94788	180.94788
74	W	tungsten	183.84	183.84
75	Re	rhenium	186.207	186.207
76	Os	osmium	190.23	190.23
77	Ir	iridium	192.222	192.222
78	Pt	platinum	195.083	195.083
79	Au	gold	196.966569	196.966569
80	Hg	mercury	200.59	200.59
81	Tl	thallium	204.38	204.38
82	Pb	lead	207.2	207.2
83	Bi	bismuth	208.9804	208.9804
84	Po	polonium	209	209
85	At	astatine	210	210
86	Rn	radon	222	222
87	Fr	francium	223	223
88	Ra	radium	226	226
89	Ac	actinium	227	227
90	Th	thorium	232.0377	232.0377
91	Pa	protactinium	231.036888	231.036888
92	U	uranium	238.02891	238.02891
93	Np	neptunium	237	237
94	Pu	plutonium	244	244
95	Am	americium	243	243
96	Cm	curium	247	247
97	Bk	berkelium	247	247
98	Cf	californium	251	251
99	Es	einsteinium	252	252
100	Fm	fermium	257	257
101	Md	meitnerium	258	258
102	No	nobelium	259	259
103	Lr	lawrencium	262	262



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EN



BL1.1W: MXT

Multiple X-ray Techniques



Synchrotron Light Research Institute (Public Organization)

www.slri.or.th

Technical Specifications

► Radiation Source:

Multipole Wiggler

► Photon Energy Range:

4-18 keV

► Photon Flux:

10^7 - 10^{10} phs/sec/0.1%bw (at 100 mA)

► Energy Resolution:

10^{-4}

► X-ray Beam Size:

6 mm (H) x 3 mm (V)

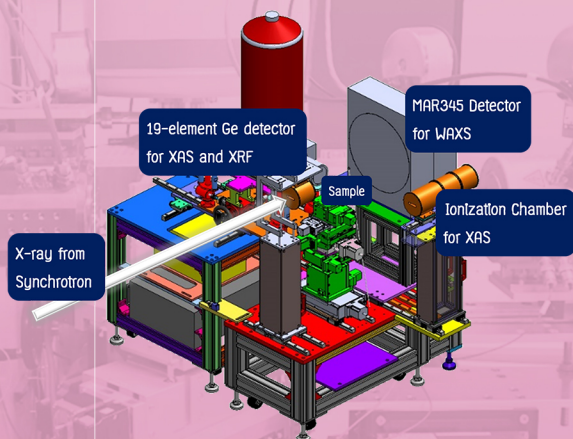
► X-ray Techniques:

- X-ray Absorption Spectroscopy (XAS)
- X-ray Fluorescence (XRF)
- Wide Angle X-ray Scattering (WAXS)
- X-ray Powder Diffraction (XRD) (end of 2018)

► Detectors:

- Transmission XAS: Ionization Chamber
- Fluorescence XAS and XRF: 19-element Ge detector
- WAXS: Image Plate detector (MAR345)

End-Station Layout

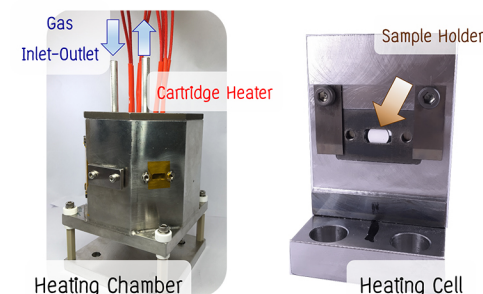


Brief Information

BL1.1W is operated on a 2.4 T Multipole Wiggler (MPW). The X-ray beam is optimized by a vertical collimating mirror (CM) and a toroidal focusing mirror (FM). The x-ray energy is scanned by using a fixed-exit double crystal monochromator (DCM) equipped with a pair of Si (111) crystals. The end-station is dedicated to various X-ray techniques including X-ray Absorption Spectroscopy (XAS), X-ray Fluorescence (XRF), Wide Angle X-ray Scattering (WAXS), and X-ray Diffraction (XRD). All experimental techniques can be requested within the same proposal.

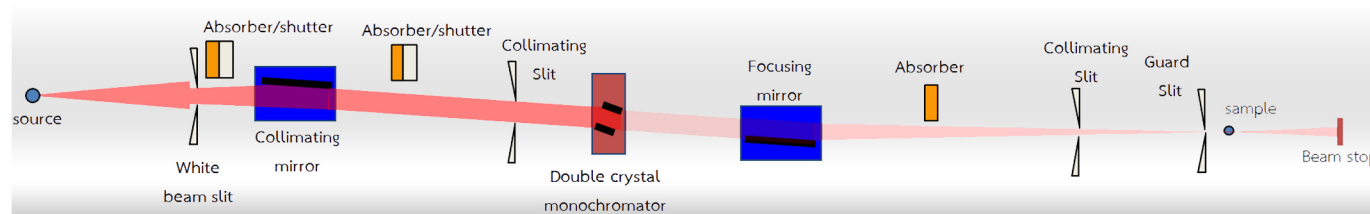
BL1.1W has been operational since November 2016, and since January 2017, under collaboration with Khon Kaen University (KKU). The beamtime at BL1.1W is divided equally between SLRI users and lecturers or researchers from the KKU. All users can submit their beamtime proposal via the SLRI website.

A heating cell is available for in-situ experiments to study the change of oxidation states or local structures as a function of temperature. The temperature program can be controlled in 3 modes, (1) continuous heating, (2) step-wise heating, and (3) step-wise heating-cooling cycles, in the range of 30-750°C. During the process, oxidizing (O_2 , air) or inert (He, Ar, and N_2) gases can be fed into the heating chamber.



XRF

XRF is a non-destructive experimental technique for elemental analysis. A detection limit down to 50 ppm could be achieved. The analysis can be done qualitatively or quantitatively.



Beamline Layout (side view)

XAS

XAS is employed to study chemical and local structures of absorbing atoms. It is a non-destructive chemical analysis which can be carried out on various materials despite their low concentration (> 100 ppm). Samples can be measured in transmission or fluorescence modes or both simultaneously.

WAXS

The crystallinity and crystal structure of materials can be investigated by the WAXS technique. The technique is based on an analysis of Bragg peaks scattered by the samples at wide angles. At BL1.1W, the angular coverage is 5-70