

Analysis of Asbestos –Distinguishing fine fiber one by one–

Product used : Transmission Electron Microscope (TEM)

Transmission Electron Microscope (hereinafter, abbreviated to “TEM”) allows for not only observation of images of internal structure/morphology and of electron diffraction patterns, but also elemental analysis combined with Energy Dispersive X-ray Spectroscopy (hereinafter, abbreviated to “EDS”). Presented here are analysis results of Amosite, Crocidolite, Chrysotile, Anthophyllite and Tremolite/Actinolite. Those asbestos were analyzed by morphological observation of TEM images, electron diffraction and elemental analysis using EDS. Since various asbestos are enabled to be identified through differences in their fibrous shapes, electron diffraction patterns and constituent elements, TEM can distinguish asbestos only from one fiber.

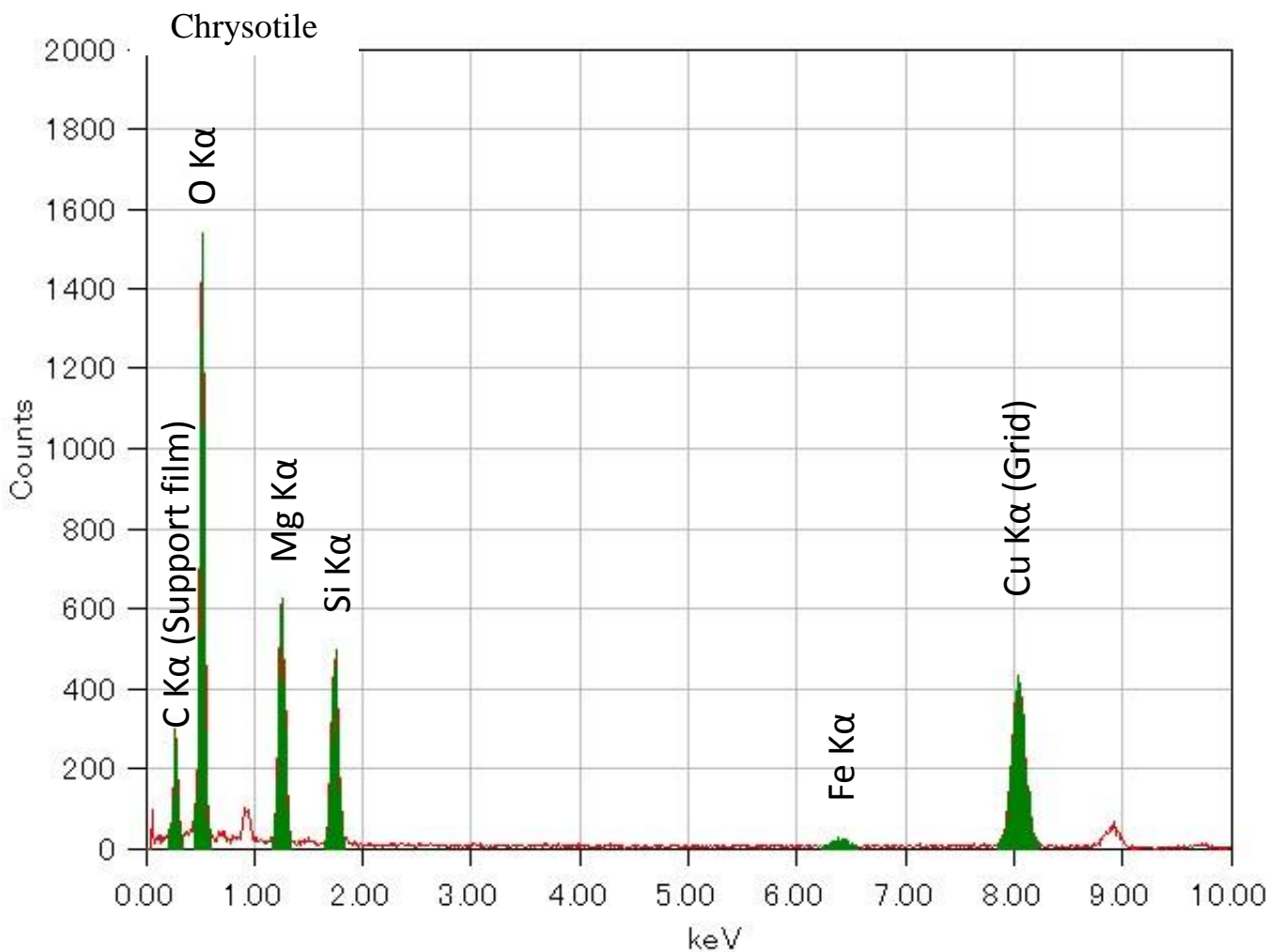
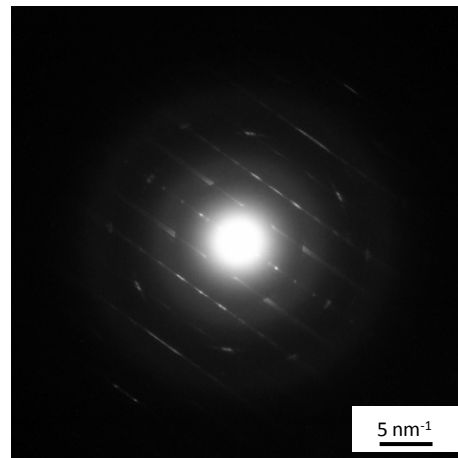
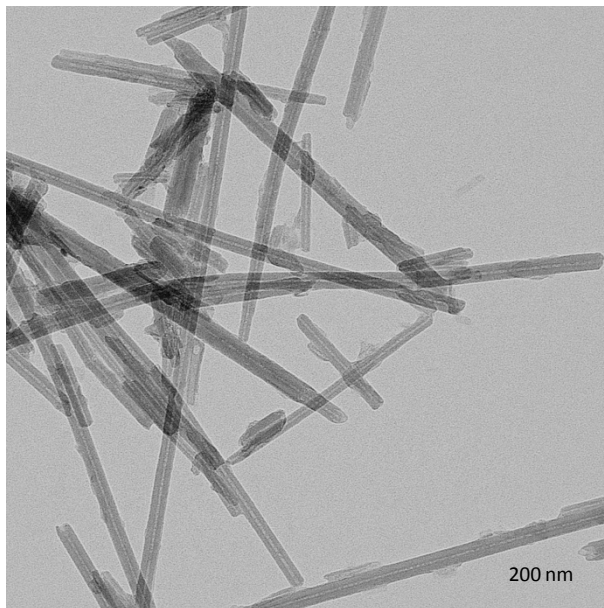
Types of asbestos

	Category	Name of mineral	Name of asbestos	Chemical formula	H	O	Si	Na	Mg	Ca	Fe
asbestos	Serpentine group	chrysotile	Serpentine, chrysotile	$Mg_3Si_2O_5(OH)_4$	○	○	○		○		
	Amphibole group	amosite	amosite	$(Fe^{2+}, Mg)_7Si_8O_{22}(OH)_2$	○	○	○		○		○
		crocidolite	crocidolite	$Na_2(Fe^{2+}, Mg)_3Fe^{3+}_2Si_8O_{22}(OH)_2$	○	○	○	○	○		○
		anthophyllite #1	anthophyllite	$(Mg, Fe^{2+})_7Si_8O_{22}(OH)_2$	○	○	○		○		○
		tremolite #1,2	tremolite	$Ca_2(Mg, Fe^{2+})_5Si_8O_{22}(OH)_2$	○	○	○		○#2	○	○#2
		actinolite #1,2	actinolite	$Ca_2(Fe^{2+}, Mg)_5Si_8O_{22}(OH)_2$	○	○	○		○#2	○	○#2

#1 : Anthophyllite, Tremolite and Actinolite are also subjected the restrictions of asbestos.

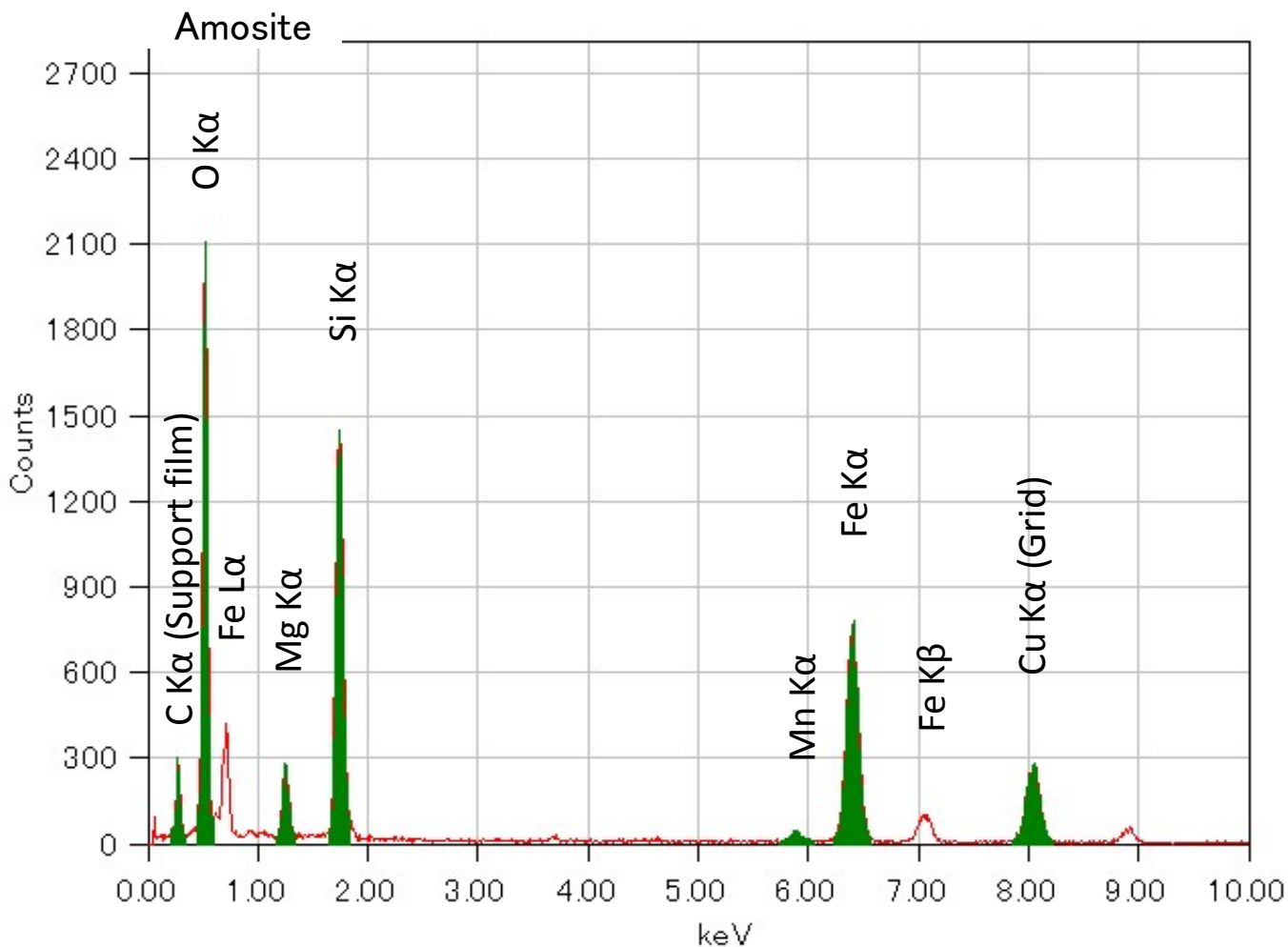
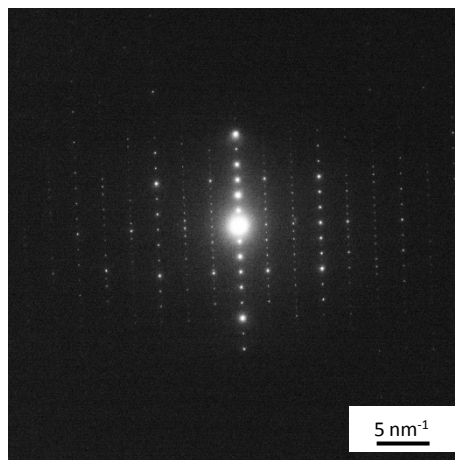
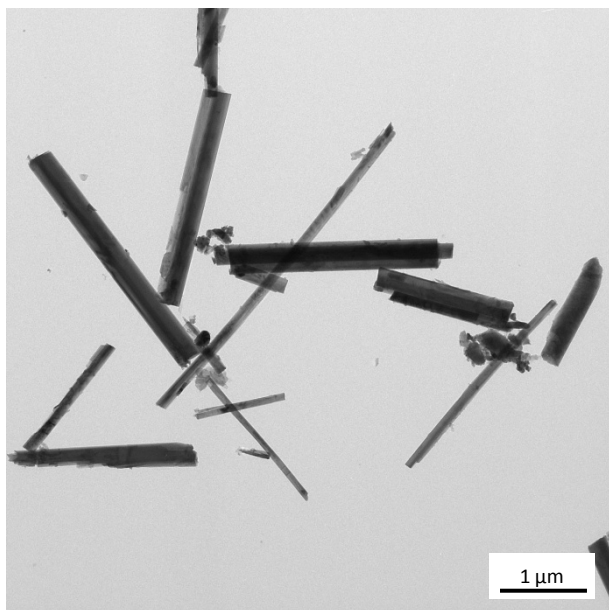
#2 : The mineral types of Tremolite and Actinolite are different depending on the content difference in Mg and Fe.

Chrysotile $Mg_3Si_2O_5(OH)_4$



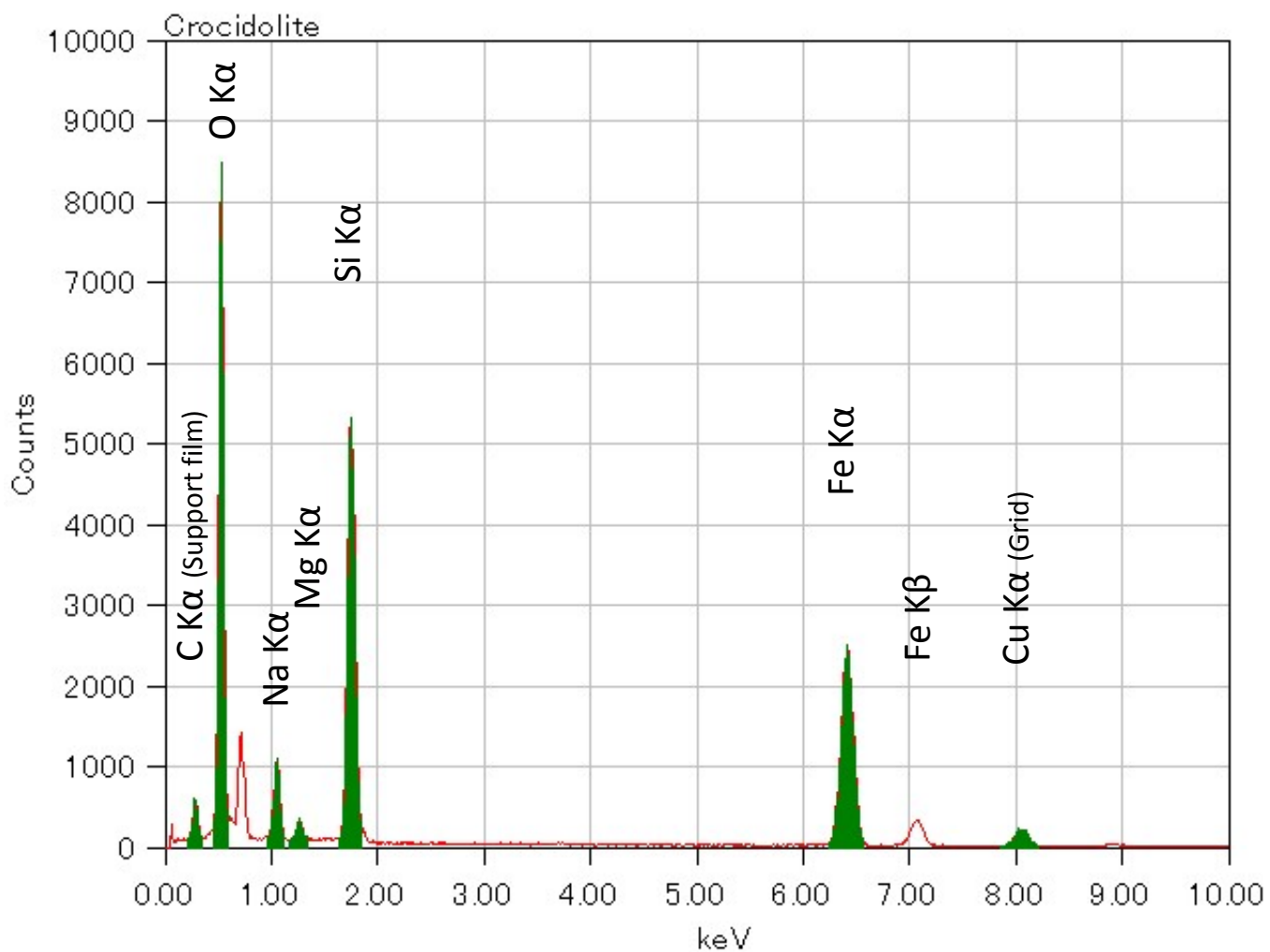
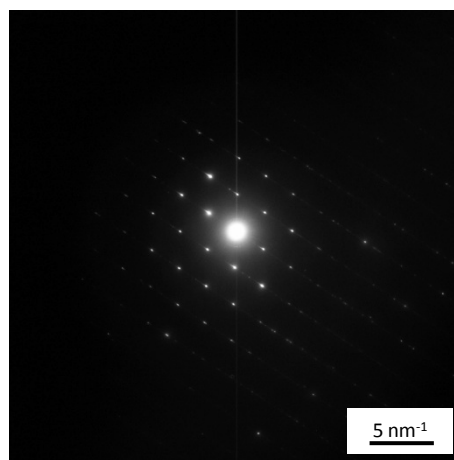
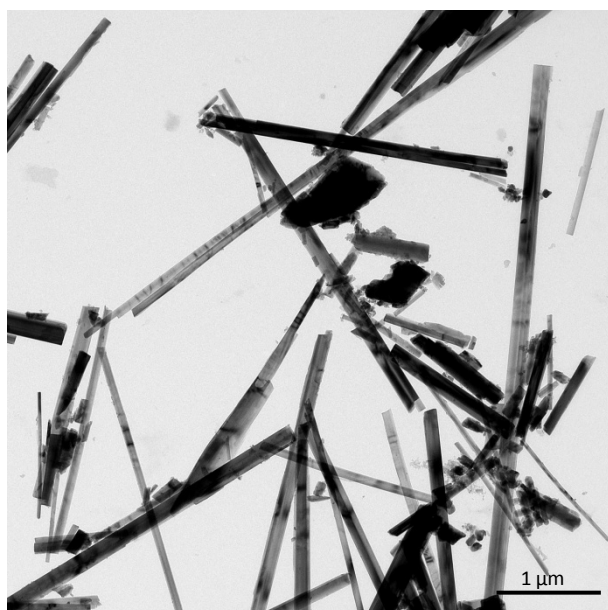
(The spectral peaks of C and Cu are generated from the elements of the support film and the grid.)

Amosite $(\text{Fe}^{2+}, \text{Mg})_7\text{Si}_8\text{O}_{22}(\text{OH})_2$



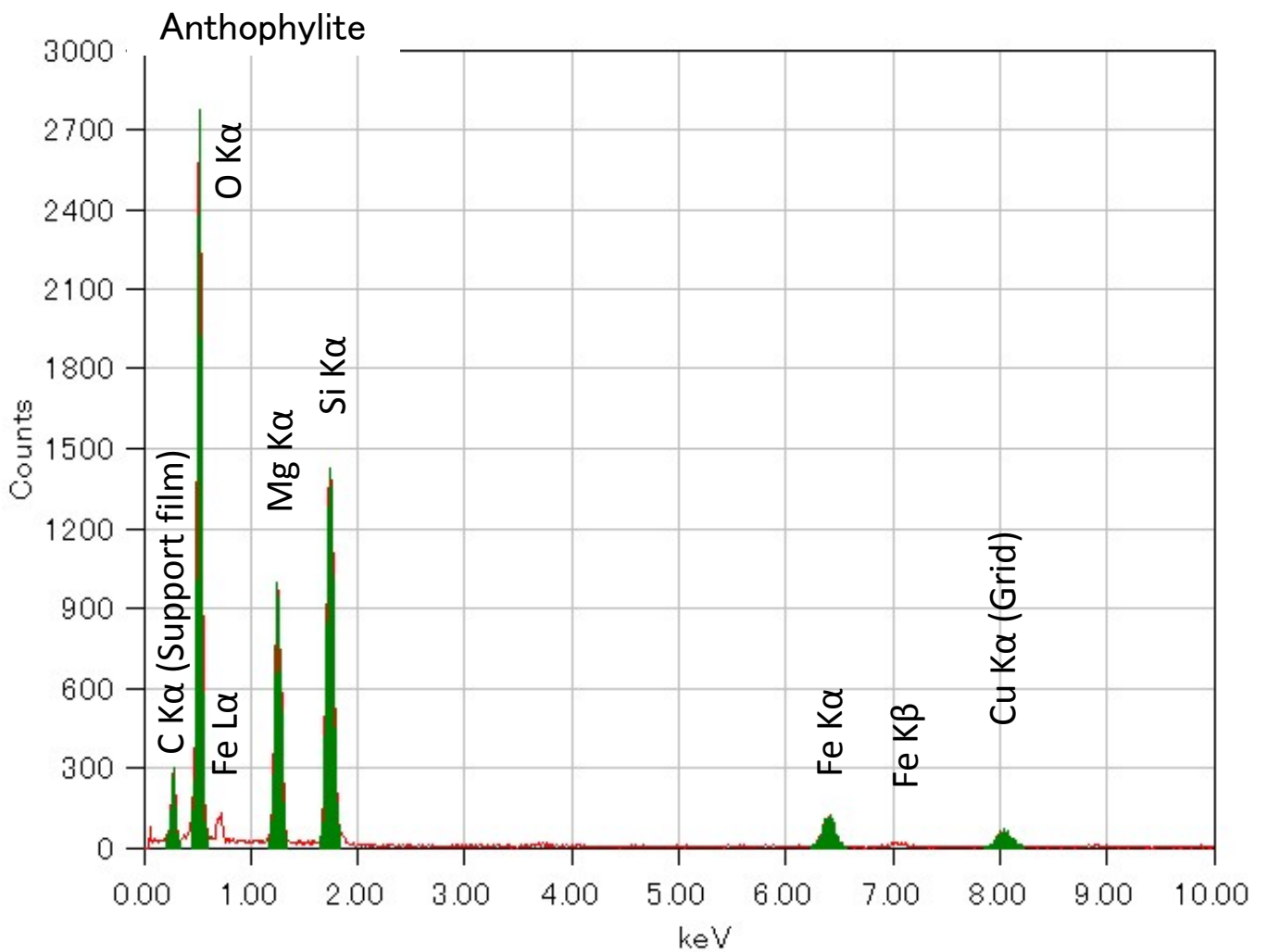
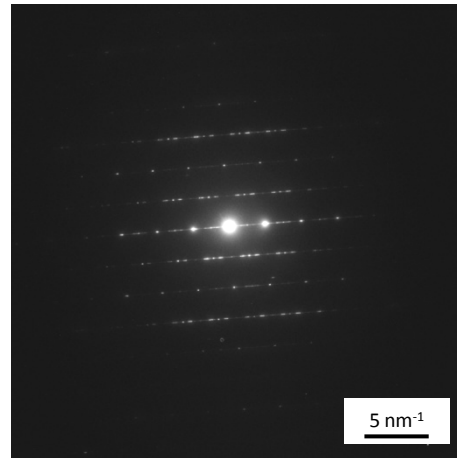
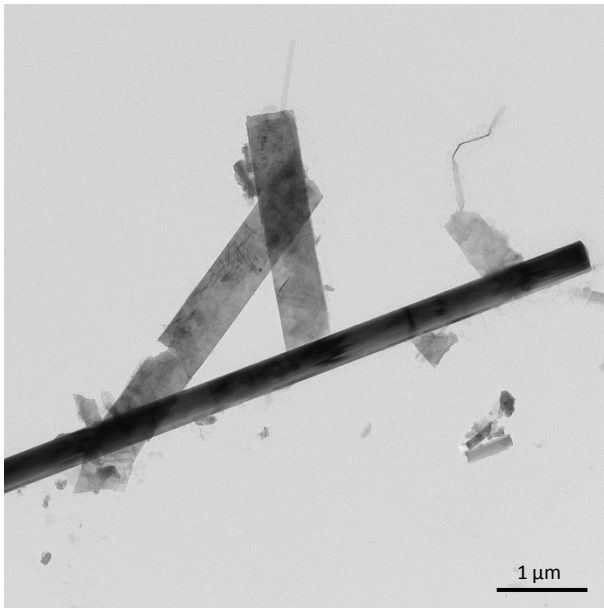
(The spectral peaks of C and Cu are generated from the elements of the support film and the grid.)

Crocidolite $\text{Na}_2(\text{Fe}^{2+}, \text{Mg})_3\text{Fe}^{3+}_2\text{Si}_8\text{O}_{22}(\text{OH})_2$



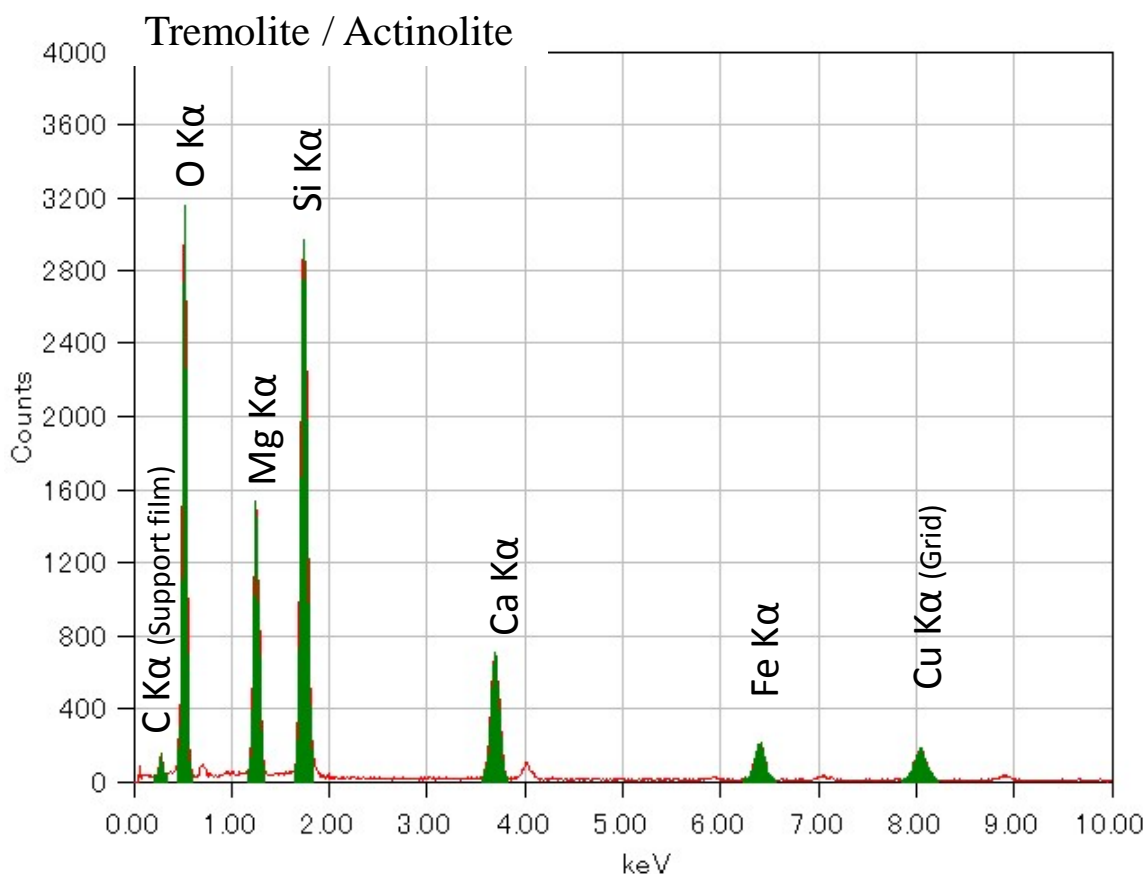
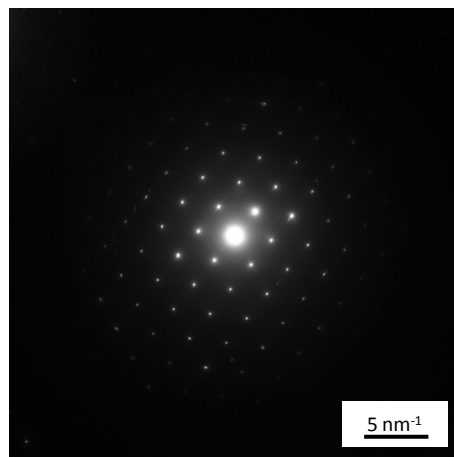
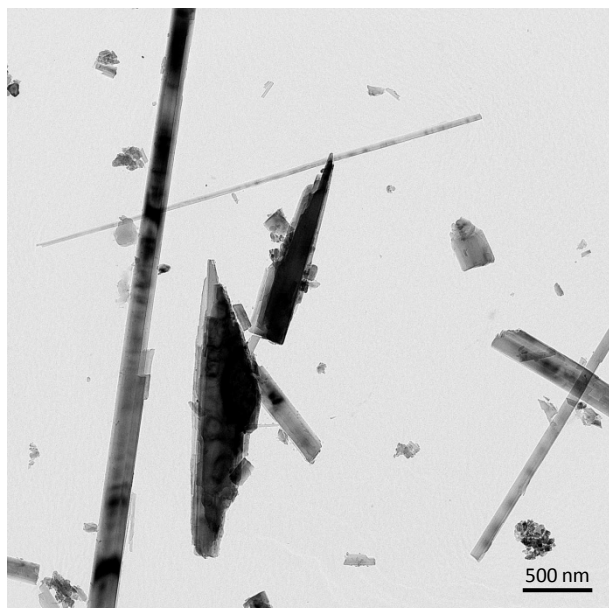
(The spectral peaks of C and Cu are generated from the elements of the support film and the grid.)

Anthophyllite $(\text{Mg, Fe}^{2+})_7\text{Si}_8\text{O}_{22}(\text{OH})_2$



(The spectral peaks of C and Cu are generated from the elements of the support film and the grid.)

Tremolite / Actinolite $\text{Ca}_2(\text{Mg}, \text{Fe}^{2+})_5\text{Si}_8\text{O}_{22}(\text{OH})_2$ / $\text{Ca}_2(\text{Fe}^{2+}, \text{Mg})_5\text{Si}_8\text{O}_{22}(\text{OH})_2$



(The spectral peaks of C and Cu are generated from the elements of the support film and the grid.)

The mineral types of Tremolite and Actinolite are different depending on the content difference in Mg and Fe.

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