

EE213. W16

Homework 1

Due: 2.11.16

Max Score = 100

Note: if you take data from the literature, you need to reference the article.

1. (50 pts.) Consider a 150nm thick garnet sample irradiated by a focused 10nm diameter electron beam of 100KeV energy. The electron beam is normal to the sample surface and the point where the beam strikes the garnet is 20mm from the front of the detector which is the same Si(Li) XRay detector as in problem2. The detector axis is 45 degrees to the sample surface. From the table below, calculate the relative mass fraction ratios of the elements indicated. The counts represent the integrated counts under the Ka XRay peak after subtracting off the bremsstrahlung XRay background. Note: you need to decide if you are able to use the thin film approximation.

Element	counts
Mg	7600
Al	9,100
Si	20.600
Ca	4,400
Ti	900
Cr	1,200
Fe	8,100

2. (50 pts) A manufacturer of a Si(Li) XRay detector claims that the detector is more than 90% efficient at detecting any $K\alpha$ XRay from Na to Nd. The specification of the detector is shown below:

3mm thick active region
10 micron thick Be vacuum window
35 nm thick Au front contact layer (ie, facing the XRays)
300nm thick Si dead layer on the front surface
20 square mm active area

A) (25 pts) Are the claims true? Explain.

B) (25 pts) Could this detector be used to detect oxygen $K\alpha$ Xrays? Explain.