

STATE UNIVERSITY OF NEW YORK AT BUFFALO

Department of Mechanical and Aerospace Engineering

MAE 589 Diffraction, Microscopy and Spectroscopy Techniques

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Homework No. 7

Problem 1: X-ray fluorescence is performed on a Au-Ge alloy.

- (24%) (a) What are the energies in keV of the $\text{AuK}\alpha_1$, $\text{AuK}\alpha_2$, $\text{AuK}\beta_1$, $\text{AuL}\alpha_1$, $\text{GeK}\alpha_1$, $\text{GeK}\alpha_2$, $\text{GeK}\beta_1$, and $\text{GeL}\alpha_1$ lines observed in the fluorescent spectrum?
- (20%) (b) The fluorescent radiation is analyzed by using a wavelength-dispersive x-ray spectrometer, which has a germanium analyzing crystal in the (111) orientation. What is the 2θ angle required to observe the $\text{AuL}\alpha_1$ line?
- (12%) (c) Will the $\text{AuL}\alpha_1$ fluorescent radiation excite $\text{GeK}\alpha_1$?
- (12%) (d) Will the $\text{AuL}\alpha_1$ fluorescent radiation excite $\text{GeL}\alpha_1$?

Problem 2 (32%)

To create an electron-hole pair in silicon at 77 K requires an average energy of 3.8 eV. How many pairs, on the average, are created by the absorption of a $\text{AuL}\alpha_1$ quantum?