Aufgabe 8-1:

The integrated intensity diffracted by an infinitesimally thin layer located at a depth x below the surface of a thick flat specimen (making equal angles with the incident and diffracted beams) may be given by:

$$dI_D = \frac{I_0 ab}{sin\theta}\, e^{\frac{-2\mu x}{sin\theta}}\, dx$$

where I_0 (the intensity of incident beam), μ (the linear absorption coefficient), $a\ and\ b$ are constant for all reflections (independent of θ). dx is the thickness of the thin layer located at a depth x below the surface.

If the "infinite thickness" is defined as that thickness t which a specimen must have in order that the intensity diffracted by a thin layer on the back side be 1/1000 of the intensity diffracted by a thin layer on the front side,

a) Determine the "infinite thickness" t.
b) Calculate the value of t for nickel powder examined with Cu k_α radiation at θ = 90° and with $\mu = 216$ cm^{-1} for powder compact.

Aufgabe 8-2:

Assume that the effective depth of penetration of an x-ray beam is that thickness of material which contributes 99 percent of the total energy diffracted by an infinitely thick specimen. Calculate the penetration depth in µm for nickel specimen (with FCC crystal structure and lattice parameter of 3.5239 Å) under the following condition:

a) Diffractometer; lowest-angle reflection; Cu kα radiation
b) Diffractometer; highest-angle reflection; Cu kα radiation
c) Diffractometer; lowest-angle reflection; Cr kα radiation
d) Diffractometer; highest-angle reflection; Cr kα radiation