Rasterkraftmikroskopie

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Mithilfe von drei Rntgenanoden sowie verschiedenen Streuobjekten konnten wir die theoretischen Werte der K_α- und K_β-Linie von Kupfer, Eisen und Molybdn besttigen. Zudem war die Feinstruktur von Eisen und Molybdn im Spektrum erkennbar. ber das Duane-Hunt-Gesetz haben wir Plancksche Wirkungsquantum zu $h = (6.645 \pm 0.059) \times 10^{-34}\,\mathrm{J\,s}$ bestimmt. Anhand des Effekts der inelastischen Streuung von Photonen an Elektronen haben wir die Compton-Wellenlnge zu $\lambda_c = (2.25 \pm 0.43)\,\mathrm{pm}$ ermittelt. Schlielich haben wir zwei Laue-Aufnahmen eines Materials gemacht, den Reflexen Miller-Indices zugeordnet und damit die Diamandstruktur der Probe identifiziert haben.

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Versuchsdurchfhrung: 05. Oktober 2012

Protokollabgabe: 12. Oktober 2012

1 Roughness of the surface

One of the goals of this experiment, is to determine a method of reducing the roughness on the wafer we want to grow on optical structures. This is important on the behalf of ithe optical quality the device can operate at. For this purpose we need to define roughness as a way to quantify the properties of the surface of interest. We think that the concept of a surface energy is a good approach to address those optical qualities. One of the simplest models of surface energy or surface tension is to assign an atom an energy depending on how many sides it has a neighbouring atom. The neighbour positions are those of the nearest neighbours in the lattice of the material. In a simple cubic lattice the energy of a free atom would be six, the energy of a surface atom would be one. Large fluctuations have a small effect, already represented by the surface energy. On the other hand very small fluctuations, much smaller than the wavelength of the light, also have a small effect on the optical properties. Since they would have a big, but also unwanted contribution to the surface energy, we need to define the size of the 'atoms' with a parameter λ. A natural choice is to set λ to the wavelength of the light which the device will interact with. All smaller fluctiations are then neglected and averaged to a mean height with the quantization of the axis in x and y direction to the length scale of λ.

$$\Upsilon = \sum_i \epsilon_i \tag{1}$$

$$\text{where} \quad \epsilon_i = \sum_{r=x,y,z} \Big(r_{i-1} + r_{i+1} \Big) \tag{2}$$

$$\text{and} \quad r_j = \begin{cases} 1 & \text{if site contains an atom} \\ 0 & \text{else} \end{cases} \tag{3}$$

2 Anhang