جامعة بيرزيت

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Phys111 Report

Experiment #1: Density of a Metal and Distance between Atoms

Name:	
Partner:	
Section:	3
Date:	6/4/2022

(1) Abstract:

Aim of the experiment:

is to Find the density of a metal as well as ~~Find~~ the distance between there atoms.

The main results are:

- The density of the metal block is $\rho = 7,40 \pm 0,04$ g/cm^3
- The distance between at atoms is $a = 2,32 A^\circ = 2,32 \times 10^{-8} cm$.

(2) Data:

Block #: S 32 **Mass (M) =** $87,5 \pm 0,1$ gm

	1.	2.	3.	4.	5.	6.
$L\ (cm)$	4,000	3,980	3,990	4,010	4,005	4,000
$W\ (cm)$	1,900	1,915	1,920	1,930	1,905	1,925
$T\ (cm)$	1,540	1,545	1,546	1,547	1,549	1,543

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(3) Calculations:

$\bar{L} = 3,9975$ cm	$\sigma_s(L) =$ 0,01083	$\Delta\bar{L} =$ 0,004 cm
$\bar{W} =$ 1,915 cm	$\sigma_s(W) =$ 0,01158	$\Delta\bar{W} =$ 0,005 cm
$\bar{T} =$ 1,545 cm	$\sigma_s(T) =$ 0,0031622	$\Delta\bar{T} =$ 0,0013 cm

$V = \bar{L} \times \bar{W} \times \bar{T} =$ $3,9975 \times 1,915 \times 1,545 = 11,8273 cm^3$. → $11,83 cm^3$

$\frac{\Delta V}{V} = \frac{\Delta\bar{L}}{\bar{L}} + \frac{\Delta\bar{W}}{\bar{W}} + \frac{\Delta\bar{T}}{\bar{T}} = \frac{\Delta V}{V} = \frac{0,004}{3,997} + \frac{0,005}{1,915} + \frac{0,0013}{1,545} = 4,4531 \times 10^{-3}$.

$\Delta V =$ $0,05 cm^3$.

$\rho = \frac{M}{V} = \frac{87,5}{11,8273} = 7,39813$ g/cm^3. → $7,40$ g/cm^3

$\frac{\Delta\rho}{\rho} = \frac{\Delta M}{M} + \frac{\Delta V}{V} = \frac{0,1}{87,5} + \frac{0,05}{11,8273} = 5,37036 \times 10^{-3}$.

$\Delta\rho =$ $0,03973 \rightarrow 0,04$. g/cm^3.

$a = \sqrt[3]{\frac{A_w}{N_A \rho}} = \sqrt[3]{\frac{55,845}{6,023 \times 10^{23} \times 7,4}} = 2,322 \times 10^{-8} cm = 2A^\circ.$
$= 2,32A^\circ$

(4) Results:

- The density of the metal block is $\rho = 7,40 \pm 0,04$ g/cm^3.
- The distance between at atoms is $a =$ $2,32A^\circ$.

(5) Conclusions:

We measured the value of iron's density and we got 7,40 g/cm³ With an error of about 0,04 g/cm³. But the true value of iron's density is 7,88 g/cm³, so when we use discrepancy test, we found ($|P_{true} - P_{we}| \leq 2 \times \Delta P$) → $(0,46 \leq 0,08)$ (not accepted) an error, i think that this error resons are that our piece wasn't a completly rectangle, maybe we use the micrometer in a wrong way by compressed it a lot, and maybe my partner wasn't good at reading the distance information. However, we measured (L, W, T) six times, to reduce the Random error.