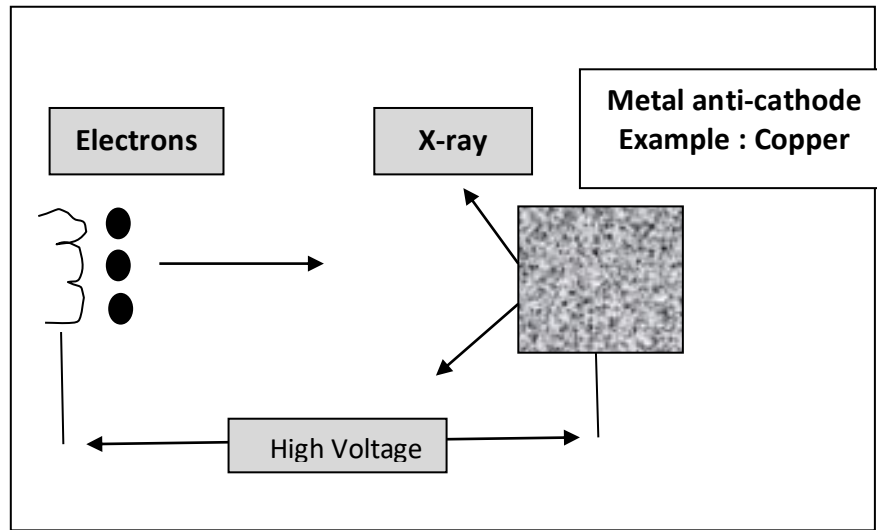


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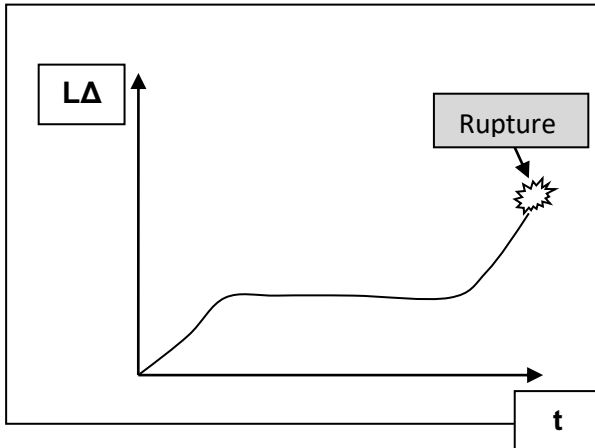
University of Biskra
Faculty of Science and Technology
Department of Mechanical Engineering
Metallurgy , Bachelor 3rd Year

Exam of Analysis and Characterization Methods /01/2025

Exercise 1. Draw a scheme for explaining the the production of X-Ray (2 pts)



Exercise 2. (2 pts)



Exercise 3. (2 pts)

a- What is the formula of the Resilience K .

The formula is : $K = \frac{mg(H-h)}{S}$

Exercise 4.

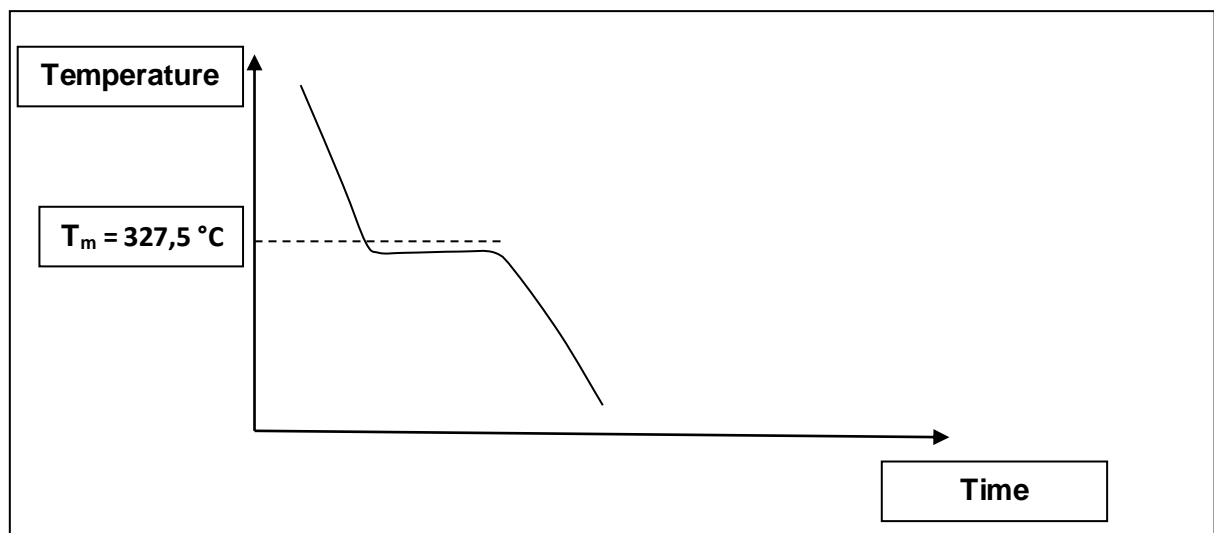
1- What are the main equipments used for performing a simple thermal analysis in laboratory ? pure Plomb ? (2 pts)

Answer :

1-Furnace . 2- Thermocouple

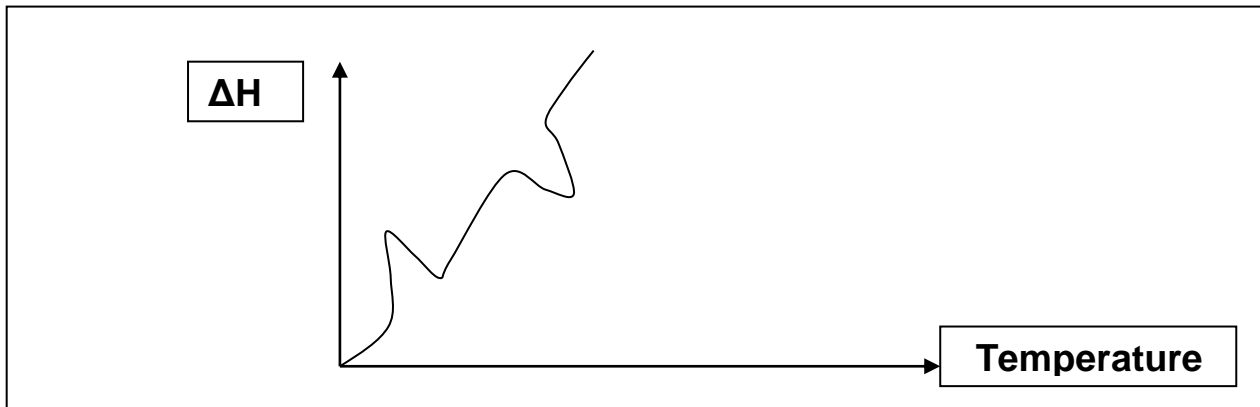
3-Chronometer 4- Crucible

2- Plot the curve which can be obtained after simple thermal analysis of pure Plomb ? (2 pts)



Exercise 5. (2 pts)

Plot the curve which can be obtained after the DSC analysis of material during heating process ?

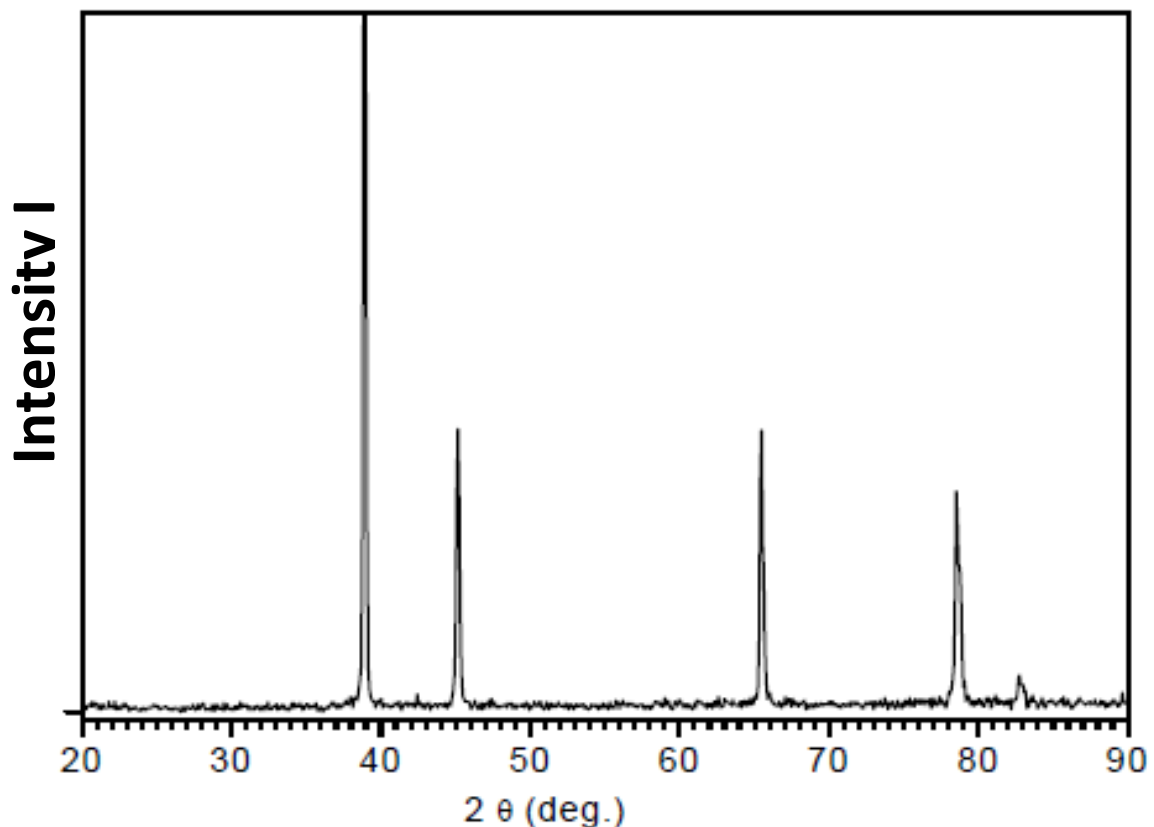


Exercise 6. (2 pts)

We know that the electron microscope (SEM or TEM) has a higher magnification than the optical microscope. But what is the metallurgical reason to use in some cases these microscopes (SEM or TEM) instead of the optical microscope? (give an example)

Answer : The reason to observe more details not observed by optical microscope like the observation of dislocation by TEM.

Exercise 5. We have an X-ray diffractogram of a pure metal. Deduce its crystal structure (bcc or fcc). (6 pts)



We have bragg law $2.d.\sin\theta = \lambda$ and $\lambda = 1.54 \text{ \AA}$

$$d = \lambda / 2.\sin\theta = 1.54 / 2.\sin\theta = 0.77 / \sin\theta$$

Peak	θ	$d = 0.77 / \sin\theta$	$(d_0)^2 / (d_i)^2$ Or, in general we write $(d_0)^2 / (d_i)^2$
1	$\theta_0 = 39/2 = 19.50$	$d_0 = 0.77 / \sin 19.50 = 2.306$	$(2.306/2.306)^2 = 1$
2	$\theta_1 = 45/2 = 22.50$	$d_1 = 0.77 / \sin 22.50 = 2.012$	$(2.306/2.012)^2 = 1.313$
3	$\theta_2 = 65.50/2 = 32.75$	$d_2 = 0.77 / \sin 32.75 = 1.423$	$(2.306/1.423)^2 = 2.626$
4	$\theta_3 = 79.00/2 = 39.50$	$d_3 = 0.77 / \sin 39.50 = 1.210$	$(2.306/1.210)^2 = 3.632$

Now if we compare this table (Values of) to the values of FCC crystal :

Application for FCC

$$(h_0^2 + k_0^2 + l_0^2) \quad 111 \quad (h_1^2 + k_1^2 + l_1^2) / (h_0^2 + k_0^2 + l_0^2) = 1$$

$$(h_1^2 + k_1^2 + l_1^2) \quad 200 \quad (h_2^2 + k_2^2 + l_2^2) / (h_1^2 + k_1^2 + l_1^2) = 1.33$$

$$(h_2^2 + k_2^2 + l_2^2) \quad 220 \quad (h_3^2 + k_3^2 + l_3^2) / (h_2^2 + k_2^2 + l_2^2) = 2.66$$

$$(h_3^2 + k_3^2 + l_3^2) \quad 311 \quad (h_4^2 + k_4^2 + l_4^2) / (h_3^2 + k_3^2 + l_3^2) = 3.66$$

We conclude that the metal has fcc structure