**Tools for Materials Science - Challenge n° 9- 40’**

**Optical Active Materials**

**What does *optically active material mean?***



1. Light Source
2. Unpolarized light
3. Polarizer
4. Polarized light
5. **Optically active material**
6. Rotated polarized light with specific rotation
7. Movable analyser
8. Observer

*Source: By Kaidor [CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0) or GFDL (http://www.gnu.org/copyleft/fdl.html)], via Wikimedia Commons-https://upload.wikimedia.org/wikipedia/commons/5/5d/Polarimeter\_%28Optical\_rotation%29.svg*

Looking at the picture above you can see a schematization of what is ***polarized light***: the beam of white light oscillates lying on all the plans perpendicular to direction of propagation of the beam; then the beam goes through the polarizing filter, the light ***oscillates on only one definite plan*** (which is determined by the polarizer axis).

This plan is rotated, as shown in the above picture, by the action of the material that, exactly for this reason, is called *optically active.* We call analyzer the second polarizing filter because it allows us to see what has happened.

**Introduction – 5'**

On the desk you have a computer with a plastic sheet envelope on the lit screen, a roll of scotch tape and what seems to be a simple black plastic piece; the latter will act as "*analyzer*" because it actually is a polarizer.

1. Stick scotch pieces with different orientation, also superimposing, on the plastic sheet envelope.

**Q1**. **How does the scotch appear if you look at it trough the polarizing filter?**

**Q2. Take a photo of this effect.**

Scotch is an *optically active material. L*et's investigate this further.

**Experience**

You can see, next to you, a box with a covered front window and a lamp; this simulates the polarized light of the computer screen (the big black plastic piece covering the window is a polarizing filter). On the other side of the box there is a pipe through which you can watch the effect of a new optically active material, in fact now we're going to use cellophane for convenience.

You have at your disposal 4 layers of cellophane and a black analyzer on a structure that you can assemble and disassemble very easily. On the analyzer you can see two letters: **D** and **L** that indicate the positions in which respectively you see the minimum(*Dark*)/maximum light brightness.

2. Set the analyzer on position D.

**Q3.** **Do you really see total Darkness through the tube?**

**Q4.Can you explain why?**

Keep the analyzer on **D**.

3. Put one cellophane sheet in the structure between window and analyzer and rotate it till the coloured arrow is on 0°. Now look through the tube.

**Q5.What do you see?**

4. Test one by one all the cellophane sheets.

**Q6. Do you think they are all alike?**

5. Now one of you should rotate the analyzer from 0° to 360° while somebody else will watch through the tube.

**Q7. What do you see?**

You have just verified the rotation of the plan of polarization ( **Why can we say that?) .**

Let's examine which are the important parameters :

Keep the analyzer on L and the cellophane on 0°.

6. Use the same structure of the previous issues (1 layer of cellophane).

**Q8. What colour is the light you see?**

Since the polarizers axis are aligned, it means that your eyes are seeing only the light whose plan of polarization has not undergone rotation.

7. Rotate by 90° the analyzer.

**Q9. What colour do you see now?**

**Q10.** For what you answered in Q9 and what you have seen rotating the analyzer **can you say you have found a first dependence of the plan of polarization? Which one and why ?** (Remember that *different* *colour* corresponds to a *different wavelength* of the light)

Keep the analyzer on B and the cellophane on 0°.

8. Add one by one more cellophane layers.

**Q11. What do you observe? [*Fill in the Table on the Answer sheet*]**

**Q12.** **What can you deduce about the second dependence of the rotation of the plan of polarization? [*Think also of the first experience with the scotch*]**

**OUTPUT WANTED: answers to Q1 … Q12**

**Answer sheet GROUP N°\_\_\_\_\_\_\_\_\_\_\_**

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**Ch.9 --- Optical Active Materials**

**Q1**

**Q2: PICTURES [*Sent by Whatsapp to your group* – *See general instruction to share pictures or files*]**

**Q3**

**Q4**

**Q5**

**Q6**

**Q7**

**Q8**

**Q9**

**Q10**

**Q 11**

|  |  |
| --- | --- |
| **Layers** | **Colour** |
| **1** |  |
| **2** |  |
| **3** |  |
| **4** |  |

**Q12**

|  |  |  |
| --- | --- | --- |
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