Materials ScienceExploration - Challenge n°1 - 40'

SOLAR WINDOW FILMS FOR HEAT CONTROL

"Heating, air conditioning, blinds and lighting can have a significant impact on buildings total running costs, especially with power and heating costs seemingly rising every year. Solar heat gain in the summer can increase the thermal load of a building up to 60%. Effective use of "insulating glass panes" or "solar control film" can reduce solar heat gain up to 77% and significantly reduce dependency on air conditioning, heating, blinds and lighting as well as contribute to more efficient temperature control".[1]

On the desk you have the following samples:

- **A Pilkington Solar Cool Double Glass Pane – *Simple***
- **B Pilkington Solar Cool Double Glass Pane – *With "D" (see below) on one side***
- **C Common glass pane**
- **D Solar Radiation Control Window Film**
- **E Nanostructured Solar Radiation Control Film**

A laptop with ***LoggerPro on-line data collection software*** is ready for use with 3 sensors:

1. Temperature stainless steel probe
2. UV intensity probe
3. Light intensity probe

The three probes are inserted in the back of the insulated testing box. Once you start collection you can observe the Temperature graph in real time [*The software has already been set to: "maximum data collection time = 5 min" and "sampling = 1 Sample/10 sec"*]

1. Insert the first sample (A) as upper surface of the polystyrene insulated box and close with the lid.
2. Turn on the light and at the same time start data collection.
3. Write down the initial temperature T1 and let data collection run for 3'. Then write down the final temperature T2 and calculate $\Delta T/3$. (= ***Temperature increase rate*** [°C/min])
4. During the 3' write down the readings of ***transmitted UV level*** and of ***illumination level***; fill the table on the answer sheet with all the data collected or calculated.
5. Repeat steps from 1 to 4 for all the other samples in the following order:
   - I. **B** with film outside
   - II. **B reversed** (film inside)
   - III. **C**
   - IV. **C + D** (marked face upward)
   - V. **C + D reversed** (marked face downward)
   - VI. **C + E** (marked face upward)
   - VII. **C + E reversed** (marked face downward)

- ***NB**: **DO NOT change** the distance between light and the box upper surface **during the whole experiment.***
- *Try to cool down the box a little bit in between the testing of two different samples (starting temperature shouldn't be too different: say less than 5°C).*

Compare results and write a short comment answering the following questions:

Q1. Which is the most effective sample (or sample combination) in keeping temperature low?

Q2. Do the samples have a preferential side? Does the heat control effect change if you reverse them? If yes, can you explain the reason?

OUTPUT WANTED: Answer to Q1, Q2 + Data Table + 1 photo of apparatus and/or detail

[1] http://solutions.3m.com/wps/portal/3M/en_EU/3MWindowFilm/WindowFilm/Applications/WindowSolarControl/

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Answer sheet

GROUP N°_____

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Sample:	UV reading (mW/m^2)	Enlightenment (lux)	T1 (°C)	T2 (°C)	(T2-T1)/3 (°C/min)
A					
B					
B reversed					
C					
C+D					
C+D reversed					
C+E					
C+E reversed					

Q1

Q2

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

- **Picture description:**

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