

ECE 4119 Assignment

Report on Band gap, Absorption & Emission Demonstration

Write a report about the class demonstration on Th 3/5. It should be no more than 2-4 pages with figures and references. The purpose of the demonstration is to study about band gap or transition energy gap between two electronic levels or bands in semiconductors or organic molecules.

The experiment involved the following materials:

- semiconductors (ZnSe, and Si for the demo with infrared camera)
- organic dyes in paper (they are very similar to organic materials for OLED)

The instruments we used are 3 lasers of different wavelengths (we discussed this in the class). We used our eyes as light power (brightness) and spectral sensors (color). In addition, we also used a PtSi infrared camera (3-5 μm) to see through a piece of Si in a previous demonstration. The photon energy of the lasers and of the ambient thermal IR light is a crucial parameter of the experiment.

The phenomena of interest are:

- excitation (the use of photons to excite or to give energy to ground state electrons - low energy level- so that they make a transition to upper states - higher energy level).
- absorption or non-absorption (the loss of photons or the preservation of photons as they pass through the materials)
- emission or re-radiation (the emission of photons by excited electrons as they relax down to ground states).

The report should contain the following:

- 1- Description of the experiment: including the materials, instruments, and experimental procedures (*materials and instruments are already described above, just add some details. More important are the experimental procedures: describe how we conduct the study. For example, we shone the laser light through the ZnSe window, and tried to observe the output beam. For Si, we don't use lasers but what did we use? Try to be very thorough and sufficient; the scientific criterion of thoroughness is this: if someone reads your report, he/she should be able to replicate the experiments to verify the results. Remember, each experimental procedure has at least one objective, if not more: it allows us to test certain ideas to make some scientific inference. Do not include experimental results in this section. It is for the next one*)
- 2- Experimental results and explanation: *Here is the crux of the report: try to be as comprehensive as possible and organize various experimental demonstrations into subsections. Or you can make a table. For example, for emission (photoluminescence), we used 3 lasers, what did we do with each laser and what did we observe? Why didn't the red laser cause any emission (luminescence) while the blue did, and the green caused luminescence on red papers but not green paper, etc.*
- 3- Further discussion: *This is to link the results above with the theory we learn: from Planck's theory of light quanta to band gap or energy gap between 2 levels in semiconductors or organic molecules. Feel free to write and formulate what you learn. This is how scientific knowledge is gained. If you wish to include external materials for the report (including graphics), make sure you cite proper references.*
- 4- A brief summary and conclusion.

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Enjoy.