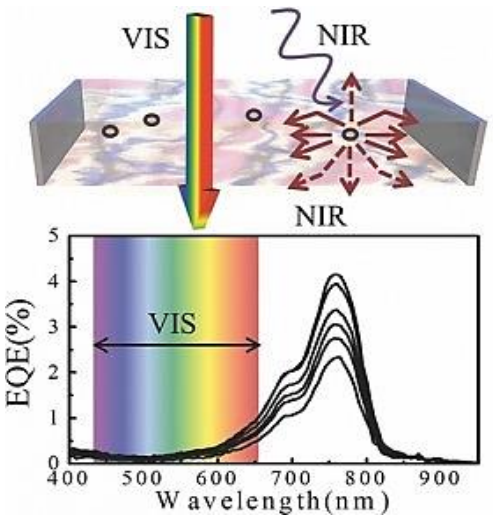
EXAMEN : BACCALAUREAT GENERAL	
EPREUVE : Evaluation spécifique de langue section européenne	
PHYSIQUE-CHIMIE en langue ANGLAISE	**Sujet N°8**

Solar window

Researchers at Michigan State University have created a fully transparent solar concentrator, which could turn any window or sheet of glass (like your smartphone's screen) into a photovoltaic solar cell. Unlike "transparent" solar cells (doc.1), this one *is* 100% transparent. According to Richard Lunt, who led the research, the team are confident that the transparent solar panels can be efficiently deployed in a wide range of settings, from "tall buildings with lots of windows or any kind of mobile device that demands high aesthetic quality like a phone or e-reader."

Doc. 1 : Transparent solar cells (video)

Doc. 2 : Principle



Traditionally, a solar panel make energy by absorbing photons (sunlight) and converting them into electrons (electricity). If a material is transparent, by definition, all of the light passes through it. This is why previous transparent solar cells have only been partially transparent.

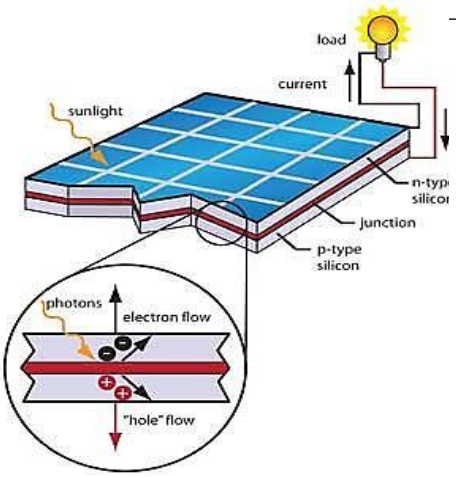
To get around this limitation, the Michigan State researchers use a slightly different technique for gathering sunlight. Instead of trying to create a transparent photovoltaic cell they use a *transparent luminescent solar concentrator* (TLSC). The TLSC consists of organic salts that absorb specific non-visible wavelengths of ultraviolet and infrared light, which they then glow as another wavelength of infrared light (also non-visible). This emitted infrared light is guided to the edge of plastic, where thin strips of conventional photovoltaic solar cell convert it into electricity.

Doc. 3 : Inside a solar cell

Solar cells are made of semiconducting materials like silicon. When sunlight strikes the cells, some electrons break away from the silicon atoms and flow through the cells to create an electric current.

Silicon is a poor conductor of electrical current so why do we use this material ?

Electrons orbit the nucleus of an atom and bumping the electrons out of orbit to form an electric current takes energy. Sunlight contains photons (particles of light energy) with just the right amount of energy to make silicon's electrons jump out and flow. (see **animation** for more information)



Michigan's TLSC currently has an efficiency of around 1%, but they think 5% should be possible. Non-transparent luminescent concentrators max out at around 7%. On their own these aren't huge figures, but on a larger scale — every window in a house or office block — the numbers quickly add up.

Questions :

1) What is a solar window ? What are its advantages compared with a traditional solar panel ?
2) What are the differences between « transparent » solar cells and transparent solar concentrator ?
3) Why are TLSC 100% transparent ? Why are they considered like wave guide ?
4) Why do we use silicon in traditional solar cells ? How is the current produced in solar cells ?
5) How efficient is a TLSC ? Is it worth to change traditional panels with solar windows ?

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