Electronic displays that fit on clothing could power revolution in lighting

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A thin film of plastic which conducts electricity and produces solar power could be the basis for a revolution in the way we light our homes and design clothes.

An international research project has begun that could help bring to mass-market organic light emitting devices (OLEDs), which could have far reaching technological implications and cut the cost of lighting by billion of pounds each year.

Because the devices are thin and flexible, lighting and electronic display screens could for the first time be created on almost any material, so that clothes and packaging can display electronic information.

The devices' uses could vary from lighting that is many times more efficient than current bulbs to clothes whose colour can be changed at will and beer cans that display the latest football results.

At present, the devices are used as displays in some mobile phones and MP3 players, but they are not reliable enough for larger screens such as in TVs and computers as they stop working after a few months.

But now an international consortium of researchers, led by the University of Bath, UK, has begun an £850,000 ($1,700,000), three-year project to put the science behind the devices on a firmer basis, so helping make them efficient enough to be worth producing for the mass market.

The consortium, called Modecom, consists of 13 groups from nine universities and two companies. Three groups are from the UK, six from the USA, and one each from China, Belgium, Italy and Denmark. The European Union is funding the European and Chinese partners.

The devices exploit a discovery made around 15 years ago that some polymers have the unusual property of either turning electricity into light, or light into electricity, depending on how the devices are made.

Because these polymers are thin and flexible, they could be used in a multiplicity of ways:

• as a transparent window. This is like a conventional window during the day, but when it gets dark a switch is turned on and the entire window area emits light in a more efficient way than conventional or energy saving bulbs, promising huge savings

• in garments which could change colour at the press of a button

• in clothing which displays strips of the polymer which run off solar power, allowing electronic messages to be displayed which can be updated. This could be useful for the emergency services such as police or ambulance

• in packaging for common goods that could be made to display electronic messages such as health warnings and recipes, or could emit light

• as a source of solar power to top up mobile phones batteries

• as lightweight, solar power sources that could be rolled up and stored and which would also be ideal for people requiring electricity in remote locations, such as field researchers, mountaineers, sailors and military

personnel.

The consortium is co-ordinated by Dr Alison Walker, of the University of Bath's Department of Physics, who said: "This is a long-term project, and the contributions of many scientists are needed for its success.

"The experimentalists make measurements to test the efficiency of the devices, but it's hard to get a clear picture of what is going on at present. This project is about making that picture clearer using computer models to develop the theory.

"Success in achieving the goals of cheap, efficient and long lasting devices is essential as we must do everything we can to reduce our energy costs."

The polymer is made from chains of molecules, and is called organic because these contain carbon. Electrons and holes injected into the polymer film form bound states called excitons that break down under electrical current, emitting light as they do so.

Dr Walker's part of the consortium's research uses a mathematical technique called Monte Carlo analysis in which computer-generated random numbers are used to plot the paths of electrons, holes and excitons as they move across the film.

The results from this can be used to calculate how the chemical structure and impurities affect the device's performance. Chemists can use this data to design more efficient materials.

The Modecom consortium will work on the molecular level and also look at the workings of the device as a whole. This research will also aid the understanding of the polymer materials used in plastic electronics in applications such as electronic paper and intelligent labels on groceries.

For a video of an OLED display:
www.universaldisplay.com/video/2002foled257.wmv

Source: University of Bath