Dotty but dashing

Nanotechnology could improve the quality of mobile-phone cameras.

Telling tales with tellurium

CAMERA-PHONES, a gimmick and a luxury a few years ago, have become ubiquitous. The International Telecommunications Union estimates that 4.6 billion mobile phones are in use at the moment. Of those, more than a billion are equipped with cameras, according to Tom Hausken, an analyst at Strategies Unlimited, a market research firm based in Mountain View, California. Dr Hausken estimates that some 800m camera-phones will be sold this year.

Yet most of the photos taken with these phones will be grainy and of low resolution—fine for capturing the essence of a moment to send to friends and family, but not good enough to frame for the wall. The reason is that both camera and lens have to be small, to fit with all the other gubbins on a phone. A typical camera-phone is equipped with a one- or two-megapixel silicon-based camera chip that is about 8mm across. Phone cameras with up to five megapixels are becoming available, but InVisage, a small firm based in Menlo Park, California, hopes to leap from that to a photographically respectable 12 megapixels, without an increase in size or cost, by adding tiny crystals called quantum dots to the process.

In a typical camera-phone, the image is focused by the lens onto a photosensitive silicon chip. Light striking this detector liberates electrons from some of the silicon atoms, producing an electrical signal that is converted by the chip's electronics into a picture. Silicon, however, is not the best material for sensing light. Its physical properties (its narrow bandgap, in physics parlance) mean that it sometimes releases electrons even though no light has fallen on it, resulting in a noisy image. On top of that, the way chips are made requires the incoming light to pass through circuitry that has been deposited on to the silicon, reducing the level of illumination.

InVisage's approach is to build the photodetector out of quantum dots on the surface of a chip, above the circuitry. A quantum dot is a semiconducting crystal just a few nanometres (billionths of a metre) across that can be engineered to absorb light of a particular colour by changing its size. The larger the dot, the redder the light it absorbs; the smaller, conversely, the bluer. Placing the quantum dots on top of the electronics means more pixels can be crammed into a given area and less incoming light is lost. Moreover, photodetectors based on quantum dots produce less noisy images, so the picture is sharper even if the number of pixels is not increased.

Edward Sargent, InVisage's chief technology officer and a professor of optoelectronics at the University of Toronto, says his firm's quantum dots are made of metal chalcogenides (which are a combination of metals such as zinc, indium, bismuth and lead with selenium, sulphur or tellurium). The dots are synthesised in a paint-like colloidal suspension which is then coated on to silicon wafers before they are cut up into chips.

In addition to using them in camera-phones, Dr Sargent is working on employing quantum dots to make solar cells. He thinks cells made this way will be comparable in cost to organic solar cells (themselves much cheaper than traditional silicon ones) while being at least twice as efficient. But commercialisation of quantum-dot solar cells is still a few years away. For the moment, he is concentrating on camera-phones.

Fonte: The Economist. Disponível em: <www.economist.com>. Acesso em: 22 mar. 2010.