

Chemistry & Industry

Some like it hot

Big brother may soon have a new way of watching you, thanks to researchers at Northwestern University in Illinois. They've used advanced film deposition methods to make heat-sensitive detectors so powerful that they can provide detailed images of the human body from several miles away.

The team, from Northwestern's centre for quantum devices, is studying QWIPs or quantum well infra-red photodetectors. Each QWIP is composed of 100 alternating layers of gallium arsenide and gallium indium arsenide phosphide. The researchers build these up, atom by atom, using chemical vapour deposition, so that each layer is about ten molecules thick.

As with all semiconductors, electrons jump from layer to layer, forming 'potential wells'. But as the QWIP layers are so thin, the electrons in the wells behave like waves rather than particles and a series of energy bands form inside the well. This is the key to

the QWIPs' operation, explains team member Jim Hoff. The energies of these bands correspond to the energy of infra-red radiation.

The QWIPs made by the Northwestern team are unique because they are sensitive to infrared (IR) radiation at two wavelength ranges, rather than one. This means that they can detect multiple IR images and are far more accurate than other IR detectors. Also, the wavelengths (3–5 μm and 8–12 μm) are not absorbed by the atmosphere. In theory, says Hoff, the QWIPs can detect an IR source from any distance.

Another advantage of these QWIPs is that the layers are extremely uniform. This means that they can be grown into an IR camera lens. NASA is building a QWIP into a camera that should be able to detect the heat traces of industrial discharges and leaks from 3000ft up. The Pentagon is also following developments keenly, with an eye to using the QWIPs in improved night vision equipment.