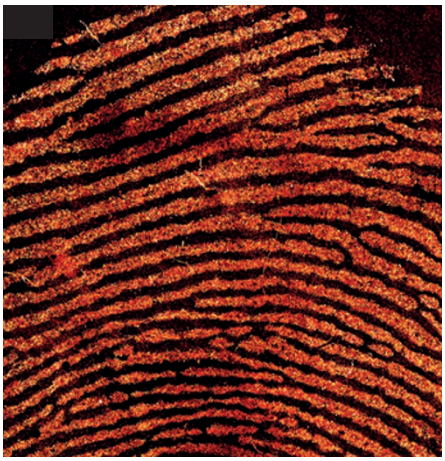
IMAGING

Fingerprint visualization

ACS Nano http://doi.org/9ps (2015)



AMERICAN CHEMICAL SOCIETY

Studies suggest that functionalized gold nanoparticles could prove useful for the visualization of fingerprints that are invisible to the naked eye (so-called latent fingerprints). Kai Song and co-workers from the US and China tested an approach that makes use of gold nanoparticles functionalized with an amphiphilic block copolymer called PSMA-b. The fingerprint sample is first immersed in an aqueous solution containing the nanoparticles for 30–45 minutes. During this immersion period the treated gold nanoparticles interact with secretions in the fingerprint residue and electrostatic forces mean that the nanoparticles are preferentially deposited on the ridges of the fingerprint. The resulting nanoparticle pattern (which follows the fingerprint pattern) is then imaged used either colorimetric imaging or photoacoustic imaging. The former allows easy visualization of the fingerprint while the latter provides better contrast and allows the study of fine features such as pores and ridges with high resolution. The use of photoacoustic imaging also offers the possibility for detecting the presence of trace samples of drugs or explosives in the fingerprint residue if gold nanoparticles functionalized with a suitable material are employed. The researchers trialled the scheme with a variety of porous and non-porous samples including paper, plastic tape, paper money, glass and a silicon wafer. *OG*

X-RAYS

Bottle spectrometer

AIP Adv. **5,** 117101 (2015)

When performing ultrafast X-ray pump–probe experiments, the ability to characterize pulses with a temporal resolution surpassing that offered by streaking techniques is sometimes desired. Shinichi Namba and colleagues from Hiroshima University and the Japan Atomic Energy Agency (JAEA) have now constructed a magnetic 'bottle' spectrometer for making such measurements. The team tested the performance of their device by characterizing pulses from JAEA's soft X-ray laser. Their magnetic bottle is made from a solenoid coil that forms the bottle's sides and provides a magnetic field strength of 10 mT when 0.2 A of current passes through the coil. A tapered permanent neodymium magnet located near the mouth of the bottle provides a magnetic field strength of 0.25 T at its tip. A 42-mm-wide microchannel detector (a device typically used for spatially resolved detection of charged particles such as electrons) was placed 600 mm from the laser focal region. A soft X-ray laser beam was focused on to a target of Xe atoms that were located a few millimetres away from the tip of the permanent magnet and electrons generated. The magnetic field serves to guide the majority of electrons to the detector and the time-of-flight spectrum of the electrons can be related to laser pulse duration and spot size. The authors determined the soft X-ray laser pulse width to be 5.7 ps, which they is claim is in good agreement with the value obtained using an X-ray streak camera. *DP*

BIOPHOTONICS

Silk nano-optics

ACS Photon. http://doi.org/9pv (2015)

Hyunsoo Kwon and Sunghwan Kim from Ajou Univesity, Korea, have fabricated biocompatible, tunable colour filters by sandwiching a thin layer of silk protein between two silver films. When illuminated from behind with white light the structure initially has a green appearance associated with a narrowband transmission resonance, but on contact with liquid, the silk layer swells and the reflection redshifts to longer wavelengths. Similar Fabry–Perot-type structures have been used as colour filters before but what makes the silk protein interesting is its strong interaction with its environment. For example, when water and acetone are introduced in varying proportions, the physical volume, or swelling, of the material can be tailored; redshifts as big as 150 nm were observed. The team also etched patterns into the silk spacer using UV light, enabling the creation of different colours in different regions. *DP*

QUANTUM CASCADE LASERS

Beam control

Sci. Rep. **5,** 16207 (2015)

A novel way to control the amplitude and phase of terahertz (THz) emitters has now been demonstrated by Francesco Mezzapesa and co-workers from Italy. A quantum cascade laser (QCL) emitting at 3.93 THz served as a THz emitter. Patterned near-infrared laser light, made by passing light from an 832-nm laser through a spatial light modulator, was shone onto a 1-mm-thick n-type silicon slab. The patterned laser light induced a photocarrier distribution in the silicon altering its permittivity. This spatial variation in permittivity can be used modify the amplitude and phase of a THz beam that is shone onto the silicon from a nearby THz QCL and subsequently reflected. The approach may lead to the creation of phase modulators, switches and active hyperbolic media that operate in the THz spectral regime. *NH*

MID-INFRARED

Tunable antennas

Nano Lett. http://doi.org/9pt (2015)

Changing the charge density in small silicon or germanium spherical resonators can tune their resonant Mie wavelength across the mid-infrared (2 to 16 μm), say researchers in the US. The approach, demonstrated by Tomer Lewi and co-workers from the University of California at Santa Barbara, could offer a route to wide, dynamic tuning of mid-infrared antennas. The team fabricated Si and Ge spheres of various sizes (0.5 to 4 μm diameter) and charge carrier densities using femtosecond laser ablation of Si and Ge wafers with different doping levels. Experiments indicate that the resonant wavelength of the resonators gets longer as the size of the semiconductor particles increases, but gets shorter as the doping concentration increases. The researchers say that the use of optical or electrical schemes to dynamically modulate the charge density of the particles could thus offer a means for fast tuning of their wavelength response. *OG*

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