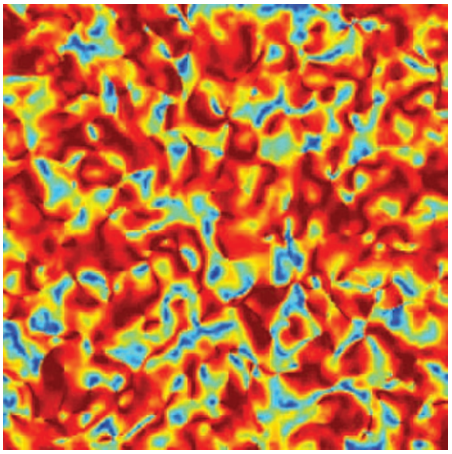
COMPLEX MEDIA

Repolarization

Opt. Express **19,** 21313–21320 (2011)



Shining polarized light into a medium that exhibits complex scattering is well-known to cause depolarization of the incident beam. Jacques Sorrentini, Myriam Zerrad, Gabriel Soriano and Claude Amra from the Institut Fresnel at the Université d'Aix-Marseille in France have now shown that such media can also locally increase the polarization of an incident depolarized beam. The team considered a coherent and depolarized beam illuminating a scattering medium whose properties are defined by the Jones matrix. Instead of using time-consuming exact theories to model the scattering behaviour, the team employed an approach based on obtaining speckle patterns from the Fourier transform of random phasor matrices. The theoretical results are in good agreement with experiments, which used MgF_2 as the scattering medium and unpolarized red light (632.8 nm) from a He–Ne laser. Using four Stokes images to measure the scattered light, the researchers showed that the scattering medium caused the incident degree of polarization to increase from 4% to around 75%. *DP*

OPTICAL MEMORY

Rephasing stored light

New J. Phys. **13,** 093011 (2011)

Using two-pulse photon echoes to slow down light in an ensemble of cold atoms may allow photon storage with ultrawide bandwidths for optical information processing and memory. However, achieving these goals will require researchers to overcome issues of low photon retrieval efficiency and short storage times. Joonseong Hahn and Byoung Ham from Inha University in South Korea now claim to have observed a 15-fold improvement in photon echo efficiency using an optical locking scheme, which the authors call atom phase-controlled optical deshelving. The researchers used rare-earth Pr^{3+}-doped Y_2SiO_5 housed in a liquid helium cryostat at ~5 K. They controlled the characteristics of the light pulses by employing the acousto-optic modulated output from a ring-dye laser, together with digital delays and radiofrequency switching. Avalanche photodiodes for detecting the output light demonstrated the rephasing of two-pulse photon echoes and provided a measured storage (spin dephasing) time of around 9 μs. The researchers say that the storage time could be significantly extended by using optically dense media and external d.c. magnetic fields. *DP*

OPTOELECTRONICS

Blue–violet reflectors

Appl. Phys. Lett. **99,** 151101 (2011)

Distributed Bragg reflectors that provide high reflectivity in the blue–violet spectral range and are lattice-matched to GaAs substrates are needed for making short-wavelength vertical-cavity surface emitting lasers (VCSELs) and investigating cavity polariton physics. Building on previous work that aimed to realize green VCSELs, Sebastian Klembt and colleagues from the University of Bremen in Germany and the Romanian Academy in Romania now present blue–violet distributed Bragg reflectors that exhibit reflectivities exceeding 99% over a bandwidth of 40 nm. The reflectors are constructed from 21 Bragg-pair layers of high- and low-index group II–VI semiconductors. The Bragg pairs, lattice-matched to the GaAs substrate and grown by molecular beam epitaxy, consist of a 41-nm-thick high-refractive-index ZnMgSSe layer and 2.8-nm-thick low-refractive-index superlattice of MgS and ZnCdSe. The researchers comprised the high-index layer from ZnMgSSe instead of ZnSSe (as in previous work) to shift the onset of optical absorption to shorter wavelengths. They found this onset to occur at 3.25 eV (382 nm) and measured a refractive index step of 0.43. According to the team, the high refractive index step and lattice matching the high- and low-refractive-index layers are both key to constructing high-quality reflectors from a low number of Bragg pairs. *RW*

TERAHERTZ PHOTONICS

Nanowire emitters

Phys. Rev. B **84,** 115421 (2011)

Nanoscale emitters of terahertz radiation would be useful for a variety of applications, including investigations into the physical properties of nanostructured materials. Denis Seletskiy and co-workers of the University of New Mexico, Sandia National Laboratories and Air Force Research Laboratory in the USA have now shown that InAs nanowires may be suitable nanoscale sources of terahertz radiation. The researchers first prepared gold nanoparticles as InAs growth precursors on the GaAs substrate surface and then used metal–organic vapour phase epitaxy to fabricate InAs nanowires perpendicular to the substrate. The nanowires were 10–20 μm tall and had diameters that tapered from 450 nm at the base to 60 nm at the tip. Terahertz wave generation was achieved by illuminating the nanowires at an incident angle of 45° with 820 nm, 60 fs pulses from a Ti:sapphire laser. The researchers measured spectra of up to 5 THz through a linear autocorrelation technique. Taking into account the fact that the filling factor of the nanowires was only around 0.03, the radiation power was about

SOLAR CELLS

Benefit of strain

Nano Lett. **11,** 4812–4817 (2011)

Applying strain could provide a new way to enhance the performance of solar cells, according to a team of scientists at Georgia Tech in Atlanta, USA. Ya Yang and co-workers have shown that the open circuit voltage of solar cells made from ZnO nanowires and the organic semiconductor P3HT on a flexible polystyrene substrate increases under compressive strain. The mechanism for the enhancement is thought to be the piezotronic effect, whereby an applied strain modifies the energy bandgap of the solar cell's p–n junction through the creation of piezoelectric polarization charge. In their experiments, the researchers found that a compressive strain of −0.4% enhanced the open circuit voltage of the cell by nearly 30% from 0.2 V to 0.26 V, while the short circuit current remained almost constant. The researchers modelled the effect with Lippman theory to help understand and predict the phenomenon. They say these findings could be used to help optimize the performance of solar cells made from wurtzite structured materials. *OG*