The ruthenium cluster dye does not respond well to light at wavelengths below 375 nm, but the titania does respond to those wavelengths. Therefore, when 350-nm light is incident on the cell, a positive photocurrent peak is produced due to the photoelectrochemical property of bare titania, which absorbs ultraviolet light and transfers the generated electrons to the electrode. Above 375 nm, the contribution of the dye depends on the properties of its excited states; when 425-nm light is incident on the cell, a negative photocurrent peak is produced. This is because the dye accepts an electron from the titania layer and is reductively quenched, followed by reduction of electrolyte and transfer of electron to the counter electrode, said the researchers. By using incident light of either 350 nm or 425 nm, current can be produced in opposite directions. Shining both wavelengths simultaneously produces no net current, as they are cancelled out. The truth table matches that of the XOR gate, and other logic gates such as an INH gate can also be obtained by varying the intensity of the excitation wavelength. The researchers said that this demonstration opens new possibilities for molecular optoelectronics.

TUSHAR PRASAD

Method Developed to Measure $\chi^{(3)}$ and Size of Spherical Nanoparticles

Developing characterization methods for nanoparticles will improve the understanding of their roles in biology, chemistry, and materials science. For example, semiconductor nanocrystals display size-dependent optical and electronic properties. Nonlinear optical characterization techniques include Z-scan, hyper-Rayleigh scattering (HRS), and third-harmonic generation (THG), but each has drawbacks. Highly scattering media, such as nanoparticle solutions, present difficulties for Z-scans. HRS requires very precise optical alignment and very sensitive detection equipment and only indirectly measures third-order nonlinear susceptibilities, $\chi^{(3)}$. For a laser beam focused in a homogeneous material, bulk THG cancels because of the Gouy phase shift on both sides of the focus. For a material within an optical cell with glass windows, however, it has been shown previously that THG still occurs in the vicinity of the glass–material interface. Recently, V.I. Shcheslavskiy (University of Southampton, UK) and co-researchers from Sofia University, Bulgaria, and the University of Wisconsin–Milwaukee exploited this fact and developed a simple, novel method that not only measures $\chi^{(3)}$ but also measures the size of spherical nanospheres.

As reported in the May 15 issue of *Optics Letters* (p. 1486), Shcheslavskiy and co-researchers used an experimental setup (Figure 1) that includes a femtosecond Cr:forsterite oscillator with a 26.5-MHz repetition rate (with a 1.25 μm wavelength, and a 40 fs pulse duration, with an average power of 300 mW) as an excitation source. The laser beam was focused on a flow-through, fused-silica cell containing either an index-matching fluid or aqueous solutions of fused-silica nanospheres with diameters of 0.2, 0.3, 0.55, 0.75, or 1.0 μm. The focal volume (~10^{-10} cm^3) contained one or fewer nanoparticles during a measurement.

The researchers derived an expression for the ratio of the TH power generated at the air–glass interface to that generated at the glass–solution interface (see Figure 1) in terms of optical constants of the two media and the refractive index of the solution under study. Another, previously published equation relates the pulse duration power for Rayleigh particles in solution (for such a material with a small inhomogeneity, a non-zero contribution to the THG is observed). These two equations were then used to solve the two unknowns, $\chi^{(3)}$ for the nanosphere solution and the nanosphere diameters, once the TH signals generated at the interfaces and inside the solution were measured. After obtaining $\chi^{(3)}$ for the nanosphere solutions of each size and for an index-matching fluid, a previously published equation relating the three quantities by the volume fraction of the nanospheres is used to obtain $\chi^{(3)}$ for fused silica for each particle size. The researchers obtained an average value of $(2.75 \pm 0.27) \times 10^{-14}$ esu, which agrees with previously reported values for fused silica. The nanosphere diameters agreed with the manufacturer's specifications to within 10%, which is also the typical standard deviation in the diameters, as stated by the manufacturer. The researchers said that their method "is simple, fast, and does not require a high-beam-quality laser source" and "can find application in monitoring structural transformations of macromolecules."

STEVEN TROHALAKI

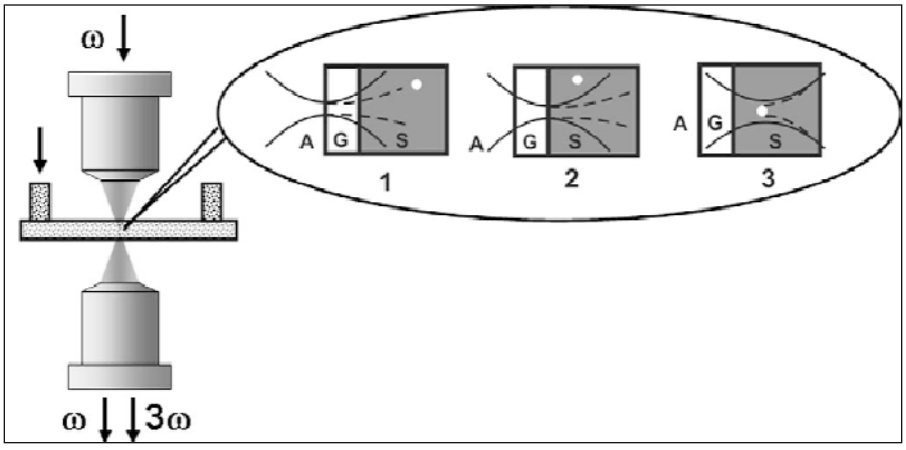

Figure 1. Schematic illustration of an experimental setup to measure third-order nonlinear susceptibilities, $\chi^{(3)}$, and size of nanospheres. A *stands for air,* G *for glass, and* S *for solution. Reproduced with permission from* Optics Letters ***31*** *(10) (May 15, 2006) p. 1486. © 2006 Optical Society of America.*

Bicolored "Janus" Particles with Electrical Anisotropy Synthesized Using a Microfluidic Co-Flow System

So-called "Janus" particles are biphasic microspheres with distinct composition and properties on each half. These particles, having such anisotropic physical properties, can be used, for example, in display devices. Producing Janus particles requires special techniques, and it is difficult to produce them in uniform size in large quantities. Now, T. Nisisako in the Department of Precision Engineering at the University of Tokyo, T. Takahashi of Soken Chemical and Engineering, Sayama Office, and their colleagues have developed a microfluidic system that allows them to efficiently produce 100-μm Janus particles. As reported in the May issue of *Advanced Materials* (p. 1152; DOI: 10.1002/adma.200502431), the device the researchers built is a fluidic module comprising a fluidic channel with two consecutive patterns: a Y-shaped channel, for combining two organic solutions to form a two-phase organic stream; and a planar-sheath-flow geometry, for leading the organic stream into a co-flowing aqueous stream.

The researchers prepared two solutions