Did You Know?

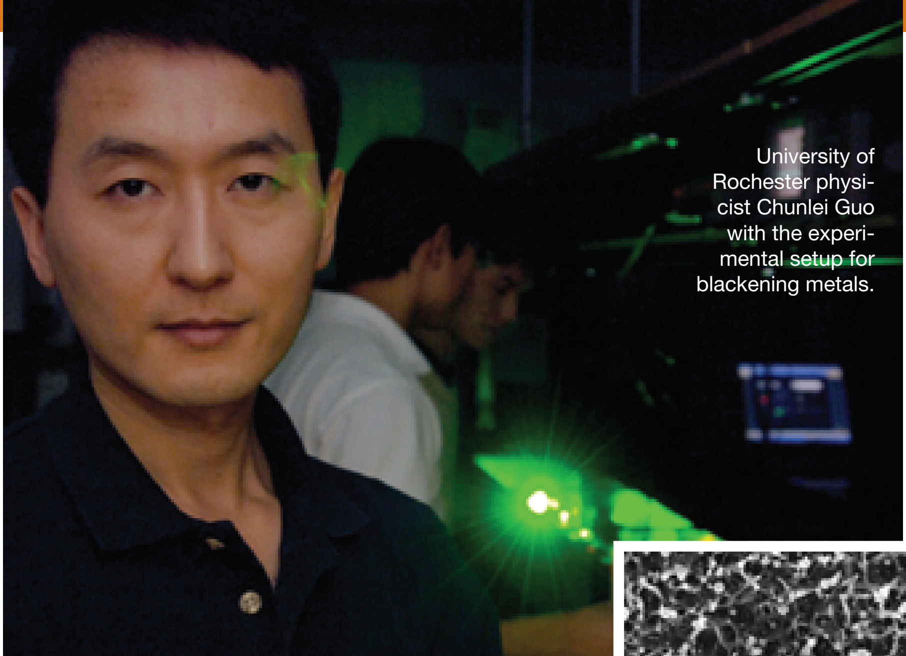
Sixty years ago this month, 400 OSA members and guests were the first to see a completely new kind of photography. At the Society's winter meeting at the Hotel Pennsylvania in New York, the informal Friday evening dinner was capped off by Edwin H. Land's demonstration of his new method for making a contact positive print inside the camera itself. Land's talk was the "most exciting part of the program," O.S. Duffendack wrote in the meeting proceedings in the *Journal of the Optical Society of America* (JOSA).

Land, president of the Polaroid Corp., also published the details of this "one-step photographic process" in the February 1947 issue of JOSA, complete with a halftone replica of a one-step photo of Lehman Hall at Harvard University. Nineteen months later, the first Polaroid Land camera, the Model 95, went on sale for $89.75 at the Jordan Marsh department store in Boston.

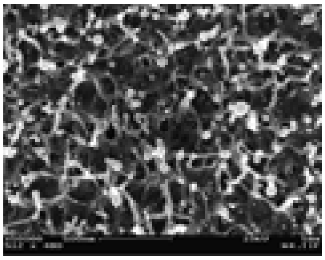
George Harrison, 1945-1946 OSA president, wrote a firsthand account of Land's famous demonstration; it appears on p. 12.

Early photo of Edwin Land (1909-1991) demonstrating an instant camera print.

OSA Historical Archives



University of Rochester physicist Chunlei Guo with the experimental setup for blackening metals.



C. Guo, University of Rochester

Microstructure Technique "Blackens" Metals

At visible wavelengths, many metals "shine," meaning that they reflect almost all incident light. A new laser-ablation technique alters the surfaces of metals such as platinum and tungsten, so that the metals absorb nearly 100 percent of the light that falls on them.

Though press reports have called the resulting metal surfaces "truly black" or "the new black," the lead researcher notes that a dark color isn't the point of the experiments. "'Black metal' is not quite a scientific term," says Chunlei Guo, assistant professor of optics at the University of Rochester. The nanoscale roughness of the metal surfaces greatly amplifies the metal's ability to absorb light.

Guo and postdoc Anatoliy Vorobyev used a state-of-the-art amplified femtosecond laser to fire high-intensity near-infrared pulses at small targets of platinum, gold, copper and other shiny metals.

The beam abrades a tiny area at a time; the area varies based on how tightly the beam is focused—between 100 μm to 1.0 mm, depending on the target metal. A single pulse can more or less "blacken" the spot, but scanning the surface with pulses makes it even darker.

The laser scanning etches polarization-dependent microstructures on the surface of the metal, with finer nanoscale structures in between them (see inset above). Guo calls them nanostructure-covered laser-induced periodic surface structures, or NP-LIPSS. They appear on a platinum surface after about 30 pulses, according to the authors' recent paper (Appl. Phys. A, rapid communication, doi 10.1007/s00339-006-3800-0).

Absorptance—the ratio of absorbed radiant or luminous flux to the incident photon— is actually a difficult thing to measure on rough surfaces because light will be diffusely scattered, Guo said. The Rochester team had to devise a laser calorimetry system to measure how much heat was left in the sample.

The high-absorptance metals could help increase the efficiency of thermal detectors, Guo said. Also, because the technique dramatically increases the surface area of metals, the research might someday find use in fuel cells and other products requiring metal catalysts. However, the initial wave of industrial inquiries has been from jewelry companies—intrigued, perhaps, by the artistic possibilities of imprinted black designs on gold and platinum.

— *Patricia Daukantas*

New Imaging Technique Reveals Body's Inner Surfaces

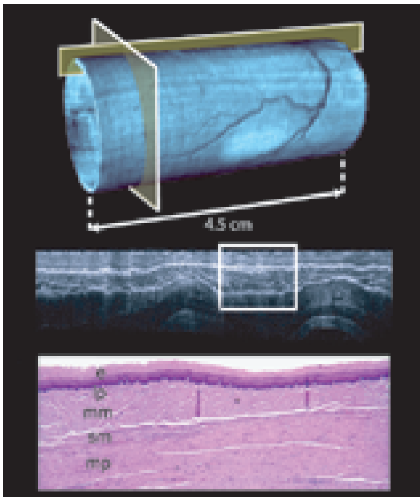
A new imaging technique can reveal larger surfaces of the inner body than previous methods. Not only could the approach help detect esophageal cancer, it could provide new insights into coronary artery disease.

The current method, optical coherence tomography (OCT), is so slow that it can image only a thin section of the esophageal surface at a time—just a few millimeters long and a few microns wide. That kind of point sampling presents clinical challenges, said Brett E. Bouma, associate professor of dermatology, health sciences and technology at Harvard Medical School. Gastrointestinal cancers are diffuse and microscopic in their early stages, and OCT's limited field of view could miss a tiny early-stage tumor while imaging a normal section of the esophagus.

Bouma and his colleagues at the Wellman Center for Photomedicine and Massachusetts General Hospital devised a new approach called optical frequency-domain imaging, or OFDI, which acquires images much faster than OCT (Nature Medicine **12**, 1429).

A one-dimensional version of the group's instrument was used in telecommunications back in the 1990s, Bouma said. The fiber-optic catheter probe contains a rotating near-infrared laser that scans the inner esophageal surface; the probe then collects the backscattered photons reflected off the tissue. Image processing renders the data into two- and three-dimensional views with a resolution of roughly 10 μm.

Bouma also believes that OFDI could be used to help diagnose coronary artery disease. Right now, it is impossible to biopsy coronary arteries in a living patient. Angiograms give physicians a sense of the size of the affected area in the myocardium, but X-rays don't show the composition of the arterial walls and whether the plaques that narrow the arteries are fibrous or fatty. Physicians hypothesize that the latter type of plaque increases the risk of heart attack.



OFDI imaging data set from a pig's esophagus. (Top) The esophageal wall shown in transverse section. (Bottom) A magnification of the boxed area (middle), revealing the layers of esophageal tissue in vivo.

In cardiology, a modified OFDI probe could be inserted through the patient's femoral artery and up through the aorta into the coronary arteries, Bouma said.

Both the gastrointestinal and cardiovascular applications have stimulated much interest. The journal article reports work done with a "clinically viable prototype" on living pigs, but the research team would like to see the technology transferred into clinical practice on humans, Bouma said. The National Institutes of Health have started to fund initial trials of the device on human patients.

The esophageal cancer study consists of imaging, rendering diagnoses, and then doing biopsies of suspected dysplasias or carcinomas. It's a really straightforward, rigorous way of verifying the work, Bouma said. Validating OFDI's worth in the area of cardiovascular disease will be much more difficult, because physicians need to follow the participating patients over time, before and after they have myocardial infarctions.

[Patricia Daukantas (pdauka@osa.org) is the senior writer/editor of *Optics & Photonics News.*]