ed a switchable superconducting quantum interference device (SQUID) by using novel magnetoquenched superconductor–normal-metal–superconductor (S–N–S) Josephson junctions formed in a loop. This arrangement of superconductor and ferromagnetic films utilized $Fe_{0.1}Co_{0.9}$ and Pb on polished Si substrates.

While the junction properties of most SQUIDs are determined at fabrication, mesoscopic magnetoquenched superconducting valve (MMSV) S–N–S junctions can be switched on and off simply by changing the direction of the stable magnetization state in the ferromagnetic film. The researchers took the MMSV, a bilayer structure that consists of a ferromagnetic film spanning a narrow superconducting bridge, one sizable step further when they formed two superconducting bridges into a loop with one MMSV in each arm. When the MMSV junctions were "on," the researchers were able to observe and study superconducting quantum interference effects in the device by applying a weak, perpendicular magnetic field. By also switching the junctions "off," the researchers demonstrated a switchable SQUID.

As reported in the September 24 issue of *Applied Physics Letters*, Eom and Johnson fabricated samples on polished Si substrates with 100-nm-thick silicon nitride cap layers. Next, they thermally deposited 110 nm of Pb in a mostly evacuated environment and then patterned the superconducting bridge using optical lithography and an Ar ion mill. They used optical lithography to define and open a window for deposition of the ferromagnetic film after the surface of the Pb was oxidized by O_2 plasma. A 170-nm ferromagnetic layer of $Fe_{0.1}Co_{0.9}$ was deposited by e-beam evaporation on top of the oxide surface. The completed devices consisted of films less than 300-nm thick.

When asked about their device, Johnson said, "The key to our success was simply trying something that nobody thought would work." Now that their design has worked, Eom and Johnson see it potentially reaching fruition in time-dependent magnetization measurements or as nonvolatile circuit elements in digital superconducting electronics.

PAMELA JOHNSON

Multilayer $Ni_{80}Nb_{20}$/MgO Mirrors Efficiently Reflect Water-Window X-Rays

An international team of researchers from the Department of Metallurgical Engineering and Materials Science, Indian Institute of Technology in Bombay and from Institut für Materialphysik, Universität Göttingen has made a multilayered mirror from alloy-ceramic oxide—$Ni_{80}Nb_{20}$-MgO—for water-window soft x-rays (2.2–4.4-nm wavelength range) by pulsed-laser deposition. As reported in the September 15 issue of *Optics Letters*, the alloy target was prepared from high-purity Ni and Nb powders, while for the MgO target, high-purity single-crystal substrates were used. The mirror was deposited on a silicon substrate, at room temperature, using an excimer laser with 245-nm wavelength, 30-ns pulse width, and 10-Hz pulse rate. A total of 40 bilayers were deposited with a deposition rate of 0.023 nm per pulse for the MgO and 0.0076 nm per pulse for $Ni_{80}Nb_{20}$. The method used to analyze the resulting multilayered mirror was grazing incidence x-ray scattering with Co-K_α radiation.

From the two types of x-ray scattering scans performed (reflectivity and transverse), the researchers obtained information about the growth of the layers and structure of the interfaces. It was found that the thickness of individual layers is 1.78 nm ± 0.15 nm, corresponding to a bilayer thickness of 3.56 nm. Also, the roughness of the interfaces was found to be only 0.35 nm. No second-order reflection was observed, consistent with the 1:1 layer thickness ratio. The atomic arrangement within the layers was established to be amorphous using high-angle x-ray diffraction with Co-K_α radiation.

The novelty of this research consists in the low value of the roughness at the interface indicating a different type of growth in MgO layers, the high reflectivity (38%) at a wavelength of 0.179 nm and the use of an alloy-ceramic oxide multilayer. The optical performance of these multilayers in the water-window soft-x-ray region is anticipated to be better than in the hard-x-ray region due to the decrease in diffuse scattering from high-frequency roughness at longer wavelengths.

IULIA MUNTELE

Polymer Used for Semiconductor and Dielectric in Photosensitive FET

K.S. Narayan and N. Kumar from Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore have fabricated a field-effect transistor (FET) which consists of a polymer semiconductor and a polymer dielectric layer along with metal contacts. The researchers reported in the September 17 issue of *Applied Physics Letters* that this FET responds dramatically to light and controls the transistor properties.

The researchers used poly(vinyl alcohol) (PVA) as the transparent, insulating medium and cast it on a glass substrate coated with a partially transparent (10%) gate aluminum electrode to form a micron-thick layer. They dissolved regioregular poly(3-octylthiophene-2,5-diyl) (P3OT), with 98.5% head-to-tail regiospecific conformation, in chloroform and spin-coated on the insulator to form a 100-nm-thick film. The source and drain electrodes were formed with 3-mm-wide gold electrodes with an interelectrode spacing of 70 μm.

The transistor exhibits large photosensitivity represented by sizable changes in the drain-source current at low levels of light, according to the researchers. They reported a current gain of ≈100 for a photon flux rate of ≈1 μW. They reported that the current gain could be increased to as high as 10^3 with higher flux rates and a 150-nm-thick layer of P3OT. They observed that the threshold of the drain source voltage needed to drive the drain current to saturation decreased with increasing light intensity.

The researchers said the light-responsive polymer FET opens a new device-architecture concept for polymer-based electronics as image sensors. "The salient feature in this device is that both the active and dielectric media are polymers. This feature can enable fabricating circuit patterns using processing routes such as ink-jet printing and soft lithographic procedures," said Narayan.

Semiconductor Reservoirs Serve as Sources of Coherent Spin Current

Researchers at the University of California—Santa Barbara (UCSB) and the Pennsylvania State University have discovered a persistent mode of spin current deriving from semiconductor reservoirs that serve as a source of coherent spin currents. In their study reported in the June 14 issue of *Nature*, they have demonstrated high-efficiency spin transfer through interfaces between *n*-GaAs/*n*-ZnSe as well as between *p*-GaAs/*n*-ZnSe under external electrical bias.

David Awschalom, director of the UCSB Center for Spintronics and Quantum Computation and head of this research team, said that previously, theories of electron transport from one material to another suggested that the spin would lose its orientation or scatter from impurities or structural effects. In this study, the spins of