Rustum Roy and co-workers at The Pennsylvania State University have demonstrated that crystalline phases can be rendered noncrystalline in a bulk solid and hard magnets can be converted to soft magnets in the solid state, both in a matter of seconds using microwave processing at temperatures far below the melting temperatures of the materials. Their latest findings will appear as a rapid communication in the December issue of the *Journal of Materials Research*, and is currently available on-line (www.mrs.org).

Microwave processing has been explored for the thermal processing, synthesis, and sintering of materials, primarily ceramics, over the last two decades. Most researchers held that the reaction and heating is due to the electric-field vector (**E**) component of the microwaves. The magnetic-field component (**H**) was considered to be negligible in the energy loss of the microwave radiation. Earlier, the researchers at Penn State were able to separate the **E** and **H** peak intensities of 2.45 GHz (~12-cm wavelength) microwaves in a cavity with a separation distance of 4 cm. This enabled them to subject identical samples at the **E** and **H** component peaks and study the effects of each, with the caveat that the materials' reaction to the fields could distort the pure **E** and **H** fields. Using this apparatus, the researchers have previously demonstrated that the magnetic-field losses are probably a significant portion, and in some cases the dominant one, of the overall loss mechanism in several materials.

In their present study, the researchers placed pellets of a stoichiometric mixture of the constituent oxides of $BaFe_{12}O_{19}$ ($BaCO_3$ and Fe_3O_4) in their apparatus in the **E**-field and **H**-field peaks of the 2.45-GHz microwaves. When placed in the **H** field, the material completely decrystallized in as little as 5 s, as shown by x-ray diffraction. In the **E** field, the material formed euhedral crystals of $BaFe_{12}O_{19}$. The temperatures of the specimens were closely monitored and did not go above 1200°C in the **H** field and 1400°C in the **E** field, well below the melting temperature. Similarly, pellets of the ferrite Fe_3O_4 placed in the **H** field rapidly decrystallized in less than 60 s. When subjected to the **E** field, Fe_2O_3 crystal peaks were observed in x-ray diffraction measurements of the samples. The microstructures of the decrystallized specimens consisted of smooth wavelike topologies separated by ~2 µm and made up of small contiguous points. The researchers were unable to explain this microstructural evolution.

In addition, the magnetic properties (B–**H** curves and saturation magnetization) of the samples from the **E** field and **H** field were measured and compared to a sample subjected to the usual multimode microwaves. The magnetic saturation moments and B–**H** curves were very different for all three. In particular, the decrystallized $BaFe_{12}O_{19}$ ferrite sample (subjected to the **H** field) was found to have become a soft magnet. This was attributed to the fact that different sublattices are excited for the different processing modes, since a crystalline material is comprised of a crystal lattice and a magnetic sublattice. According to the researchers, this suggests the possibility of "tuning" ferromagnetic materials using **H** field microwave processing.

This work possibly opens two synthesis routes. First, it might now be possible, using the microwave magnetic field, to decrystallize *bulk* solid materials without going through a liquid or other state. Second, magnetic properties of a material now appear to be amenable to control using appropriate electric- and magnetic-field components of microwaves.

GOPAL RAO

Solar Radiation Provides Inexpensive Substitute for Laser Surgical Technology

Because of their high power density, some of the most typical effects of surgical lasers on biological tissue are fast and

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localized coagulation, dehydration, and ablation. The fiber-optic laser technology used during this procedure can develop up to tens of watts of radiation at power densities up to tens of watts per square millimeter. In order to consider other light sources as alternatives to surgical lasers, the light sources should be able to concentrate radiation to these levels. With this requirement in mind, a group or researchers from the Ben-Gurion University of the Negev in Israel turned to sunlight. Solar radiation provides an inexpensive option with the potential for building small devices, and it performs as well as the surgical lasers, as the investigators demonstrate in their article in the September 30 issue of *Applied Physics Letters*.

D. Feuermann, J.M. Gordon, and M. Huleihil built a prototype from commercial materials based on a parabolic dish, which collected the solar radiation and supplied it through an optical fiber 1 mm in diameter. The maximum power supplied was 8 W, giving a flux concentration in excess of 11,000. Operating at similar levels to those used in studies for surgical lasers (about 5 W), the researchers conducted experiments in fresh chicken breast tissue. The contact exposures affected a small, well-defined area that coagulated and later ablated, and the plume of water vapor observed indicated the tissue dehydration that usually appears after coagulation. Bubbling and rupture of tissue was later observed, as well as posterior carbonization and ablation, consistent with the stages of traditional laser surgery. After several exposures positioning the fiber tip at different heights from the tissue, different carbonization rates were obtained: 0.2 mm/s at a height of 2 mm, 0.3 mm/s at a height of 1 mm, and 0.5 mm/s when making direct contact with the tissue. Experiments at similar conditions of power density using lasers with wavelengths of 515 nm and 1064 nm gave carbonization rates of 1 mm/s and 0.1 mm/s, respectively, when making direct contact with the tissue. Since the spectrum of sunlight includes wavelengths between 350 nm and 2200 nm, one might expect an intermediate carbonization rate when using solar radiation at the aforementioned conditions, as was observed in this study.

Applications of solar radiation for surgical procedures are limited to those requiring wide-angle emissions, therefore precluding those procedures requiring collimated light like retinal surgery. Future studies include quantification of the rates of tissue transformation and comparisons with laser surgical experiments.

SIARI S. SOSA

STM Indicates CuO_2 Can Form Stable, Atomically Ordered Layer at the Surface of $Bi_2Sr_2CaCu_2O_{8+\delta}$

Researchers at the University of Illinois at Urbana-Champaign have demonstrated that a single copper oxide plane can form a stable layer at a cuprate superconductor's ($Bi_2Sr_2CaCu_2O_{8+\delta}$) surface. This plane behaves differently when exposed at the surface than when buried inside the crystal, the researchers discovered, offering insight into the behavior of high-temperature superconductors.

As reported in the August 19 issue of *Physical Review Letters*, physics professor Ali Yazdani, graduate student Shashank Misra, and colleagues used a scanning tunneling microscope (STM) to image the copper oxide plane. The $Bi_2Sr_2CaCu_2O_{8+\delta}$ sample was cleaved in vacuum, exposing a mostly BiO-terminated surface. How-