The Art of Photography Applied as a Scientific Tool

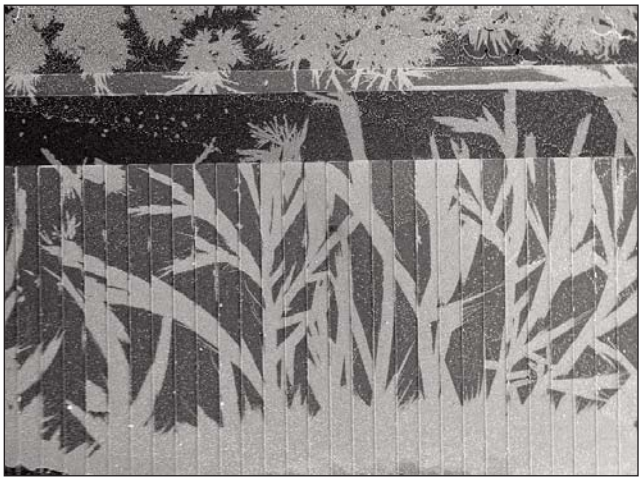
Art and science each have their own distinct vocabularies, a set of terms that only those within the field can (or want to) understand. But for all the insider jargon that artists and scientists use to describe their work, practitioners in both fields also employ a language that is universal—they depend on the visual to communicate otherwise impossible-to-visualize processes and phenomenon.

It was these commonalities that we found most striking about the Science as Art exhibition on view at the 2008 Materials Research Society Spring Meeting in San Francisco. Here was a group of scientists who realized the aesthetic value of the images they were creating, and not just as passive agents documenting what they saw under the microscope, in the service of proving or disproving a hypothesis. These scientists/artists enhanced and stretched and played with the image's connection to reality—which, to the untrained eye looking at the nanosphere, is surreal enough to begin with.

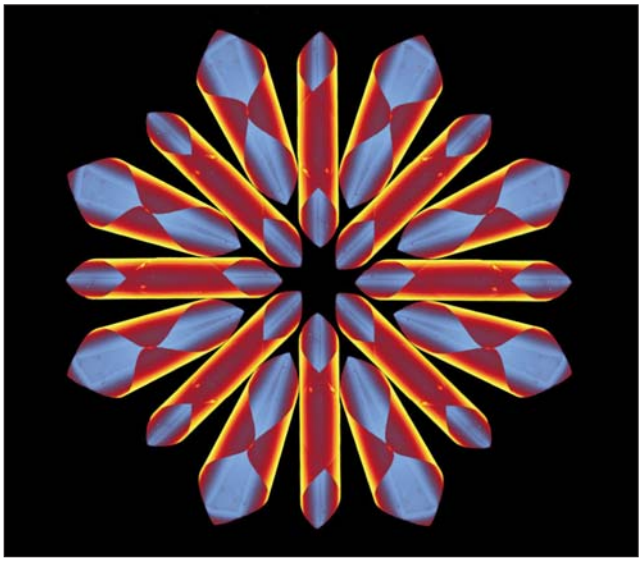
We were treated to a Hudson River landscape in microcosm, and nanowire bundles with an uncanny resemblance to the work of Vincent Van Gogh. We saw objects that seemed so far removed from any connection to real space or volume that they become pure abstractions, similar to the "Op Art" of the 1960s. Other pictures would not look out of place among pieces by the community of painters, photographers, filmmakers, architects, and designers at the art school where we study and work—an art historian could classify them as Pop Art, Color Field Painting, early 20th century photograms, Impressionism, and so on.

A handful of images of exceptionally high quality stood out from the 50 chosen for the exhibition, and we found two of them to be particularly compelling. We chose these works not for their skillful digital manipulation, or the enhanced intensity of their colors, or for the degree to which they mimic another famous artwork or feature of nature, but rather for the outstanding acuity of their creator's aesthetic eye and a unique approach to using the artistic medium of photography as a scientific tool.

The ghostly traces left behind by the movement of latex spheres in Xiaoli Li's (University of Southampton, UK) scanning electron microscope (SEM) image create an intriguing scene that hovers between abstraction and representation. Though the shadowy grayscale and complete lack of depth gives us few visual clues as to what we are looking at, we read into the image a row of plants or trees, a fence-like structure, a scattering of fireflies or stars. A dreamlike quality pervades the work, reminiscent of the Blaschka collection of botany-inspired glass sculpture from the 19th century. We especially admired Li's decision to leave the image in its original black and white rather than distract the eye with Photoshop tricks. In an era when image-makers have a mind-boggling array of tools for digital enhancement and manipulation, it must have taken a great amount of restraint to leave this image unaltered and to allow its rough-edged simplicity to emerge. (The photo is an original SEM image taken from a pre-pattern silicon wafer with self-assembled latex spheres, 500 nm in diameter.)



Ghostly Traces of Latex Spheres
Xiaoli Li's, University of Southampton, UK



Vibrant Burst of Color
Minrui Yu, University of Wisconsin–Madison

The Vibrant Burst of Color is elegantly composed by Minrui Yu (University of Wisconsin–Madison) in accordance with the symmetrical nature of the lattice constant mismatch between silicon and germanium. Her "self-rolling" tubes are arranged along a perpendicular axis that creates a visually compelling "ribbon flower." What interested us most about this image was Yu's mastery of the materials she was working with—a sought-after skill in both art and science. An important element in appreciating a piece of sculpture is to consider the process involved in its making: what are the physical characteristics of the sculptural material, and how does it behave under certain conditions? Has the artist spent a significant amount of time with the material to learn how to control it, to experiment with its potential, and to achieve the desired end result? Yu seemed to recognize the appealing formal qualities inherent in the tube structure and realized their aesthetic possibilities "by careful design of the patterns that roll into the tubes, and aligning them in certain lattice direction," which resulted in a complex array of tapered, multi-turned tubes with graceful curves and folds. The illusion of a light source illuminating the flower from behind gives it an ethereal, floating quality that we were pleasantly surprised to find in a grouping of semiconductor microtubes. (The photo combines SEM images of two different tube structures. The longer tube is 37 μm long and 7 μm in diameter. The

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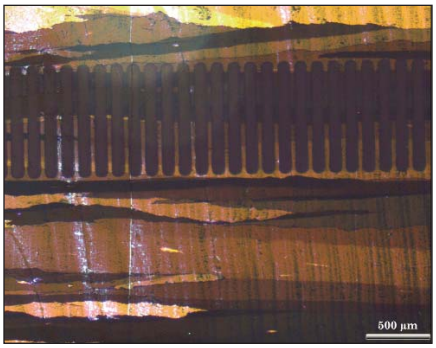
Sunflower-Like Nanowires
S.K. Hark, The Chinese University of Hong Kong



Organic Thin-Film Transistors
Zihong Liu, Stanford University

Forest Fire of Nanotubes
Blythe Gore, Max Planck Institute for Metals Research, Stuttgart

shorter tube is 32 µm long and has a diameter of 16 µm at one end and 11 µm at the other.)

Working in the field of art and design, we are constantly confronted with images that we are required to analyze and assess, images that are bizarre, innovative, provocative, confusing, exhilarating, shocking. Perhaps this is why we were drawn to the two works described, and took a kind of optical refuge in these images that are at once simple and complex, elegant and rough.

The popular vote gathered from conference attendees elected three dynamic images for first place: sunflower-like nanowires (S.K. Hark, The Chinese University of Hong Kong), a dense and multilayered landscape created by highly sophisticated organic thin-film transistors (Zihong Liu, Stanford University), and a forest fire of nanotubes ablaze with a bright hue of orange (Blythe Gore, Max Planck Institute for Metals Research, Stuttgart), respectively. The sheer intensity and vitality of the images favored by a scientific audience suggests that, in contrast to what they might come across in the course of their work, the more extraordinary and unusual images stand out from the rest.

Regardless of whether they were chosen by "artists" or "scientists," the fact that each of the works selected for Best in Show were of such consistently high quality is a testament to the ability of a powerful image to speak to many different audiences.

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