show these fossils to be at least 20.6 million years old—5 million years older than had been thought—but they were unexpectedly modern. The shoulder socket, or glenoid, was round, suggesting that *Morotopithecus*'s shoulder joints were mobile, allowing this ape to hang by its arms in trees, as do living apes such as chimps and orangutans. And the lower part of the femur has modern features, says MacLatchy. "Given these traits, we think it was a sister species to living apes," she says.

The new data will likely lead to a rearrangement of where different Miocene apes sit in the primate family tree and may also change researchers' views on which traits are most reliable for determining ancestry. For example, if the large-bodied *Morotopithecus* is our close relative, then large body size is a primitive trait for all apes, contrary to existing models. What's more, some molecular clocks assume that great apes—orangs, chimps, gorillas, and humans—split off 13 million years ago, using the date from a Pakistani ape called *Sivapithecus*. The new date for *Morotopithecus* could alter those calculations, says Kappelman.

Others caution that it is too early to be redrawing family trees, noting that both claims rely mainly on skeletal traits rather than on the teeth or skull features usually used for classification. University of Toronto paleoanthropologist David Begun, for example, notes that the classification of *Morotopithecus* as a sister group to living apes depends primarily on just two skeletal bones, one of which is very fragmentary. Nor are Begun, Ward, and others convinced that the new arm bone of *Kenyapithecus* is ape-like; they are waiting for a published description of the fossils. "I think we can expect continuing clouds of discomfort as to how to handle all this new material," says Kappelman. "But it's the beginning of a great research enterprise."

–Ann Gibbons and Elizabeth Culotta

SEMICONDUCTORS

Growing Crystals With a Twist

Researchers who make semiconductor crystals for computer chips and other electronics applications are notorious perfectionists—and for good reason. To give the best performance, a chip has to be nearly defect free. But growing perfect crystals is difficult because of mismatches between the atomic lattice pattern of the semiconductor and the substrate, a supporting surface that provides a template for the crystal being deposited on top. As a result, strain builds up in the growing lattice, triggering cracks in the crystal. Now, however, researchers have found a simple way to ease the strain.

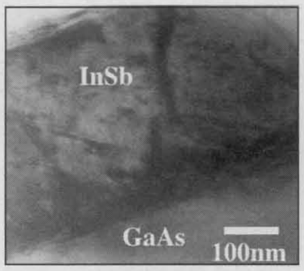
At the semiannual Materials Science Research meeting in San Francisco 2 weeks ago, a team of researchers from Cornell University in Ithaca, New York, and Sandia National Laboratory in Albuquerque, New Mexico, reported that a thin, flexible film sandwiched between the substrate and the crystal can act as a buffer. By absorbing the strain, it allows a wide variety of crystalline materials to be grown on the same substrate material virtually defect free, even when the distance between atoms in the two lattices differs by as much as 15%—a considerable mismatch by industry standards.

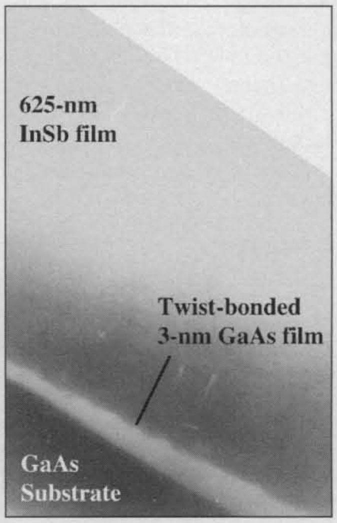
According to David Jesson, a semiconductor growth expert at Oak Ridge National Laboratory in Tennessee, the team's findings are "very interesting" because they may allow scientists to create high-quality crystals of new semiconductors. And that, says Cornell team leader Yu-Hwa Lo, could open the door to higher performance computer chips as well as new optoelectronic devices, such as more sensitive infrared detectors and chip-based lasers that beam out colors across the rainbow.

Up to now, crystal growers have been in a bind. They need substrates to organize the growth of semiconductor crystals, but standard substrates do this a little too well. Their atoms are locked into such a strong, rigid lattice that when strain builds up between the two layers, it's inevitably the more fragile, still-forming crystal that fractures. So, Lo and his colleagues decided to see if they could create a sacrificial layer that would absorb the building strain and fracture, thus sparing the growing crystal.

Their strategy was to top the substrate material with a few weakly bound layers of atoms that could move around and absorb the strain. But because any atoms deposited directly onto the substrate would be locked into the same rigid lattice, creating this weak layer required a little ingenuity. The team started with a slab of gallium arsenide (GaAs), a standard substrate crystal, coated with a layer of indium arsenide. Then, they added a film of GaAs as little as five atomic layers thick, which ultimately would serve as the flexible film. Finally, they took a second slab of GaAs and bonded it on top—but with a twist.

Instead of stacking the two slabs neatly, like playing cards in a deck, the scientists rotated the top GaAs slab so that its lattice was at a 45° angle relative to that of the substrate slab and the GaAs film, below. The researchers then used two conventional etching solutions to eat away the bottom two layers until only the ultrathin GaAs film was left attached to the second GaAs substrate. This served as the new substrate and starting material for growing high-quality crystals.





Sacrificial film. Strain builds between GaAs substrate and InSb crystal, causing fractures (*left*). But twist-bonded film sandwiched between the two layers absorbs strain, yielding a near-perfect crystal (*right*).

F. E. EJECKAM, M. L. SEAFORD, Y. H. LO/CORNELL UNIVERSITY AND H. Q. HOU AND B. E. HAMMONS/SANDIA LABS

When the researchers tested their new substrate by growing new semiconductor compounds on top, such as one made from indium antimonide (InSb), the difference was readily apparent. InSb films grown on conventional substrates are normally riddled with as many as 10 billion defects per square centimeter. But on the flexible substrate, the defects were reduced over 1 millionfold to an undetectable level.

Lo explains that bonding the GaAs slab and ultrathin film together at an angle "dramatically changes the property of the [film]" by preventing the thin film's atoms from forming rigid covalent bonds with the bulk GaAs substrate. "That allows the atoms [in the thin layer] to move," absorbing strain, he says.

This ability to turn out relatively defect-free semiconducting crystals could speed up the commercialization of blue lasers using semiconductor chips made from gallium nitride (GaN), says Lo. Because there is no cheap substrate with a lattice closely matched to GaN, lasermakers end up with GaN films containing billions of defects, which can trap heat and cause the devices to burn out rapidly. The Cornell researchers have yet to show that their technique can be used to build better GaN lasers or other working devices, but Lo says they are already gearing up to do just that. If the technique works, it will undoubtedly inspire other semiconductor researchers to search for a little more perfection of their own.

–Robert F. Service