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|  | |  |  |  |  |  | | --- | --- | --- | --- | --- | | S:\SharePassport\Website\Weebly\Science\Img\imscn031610_01_01 (1).jpg | [***Metallic Glass Yields Secrets Under Pressure***](#_Tuesday,_March_16,_1)  *Mar. 16, 2010*  *Metallic glasses are emerging as potentially useful materials at the frontier of materials science research. They combine the advantages and avoid many of the problems of normal metals and glasses, two classes of materials with a very wide range of applications. For example, metallic glasses are less brittle than ordinary glasses and more resilient than conventional metals. Metallic glasses also have unique electronic behavior that scientists are just beginning to understand.* | **Sanwhole**  RSS FEEDS   |  | | --- | |  |   S:\SharePassport\Website\Weebly\Science\Img\rss.png  SANWHOLE  S:\SharePassport\Website\Weebly\Science\Img\rss.png  Science   |  | | --- | |  |   Sanwhole | |  |  |  | | S:\SharePassport\Website\Weebly\Science\Img\imscn032410_03_01_web.jpg | [***New Bird Fossil Hints at More Undiscovered Chinese Treasures***](#_Tuesday,_January_24,)  *Mar. 25, 2010*  *The study of Mesozoic birds and the dinosaur-bird transition is one of the most exciting and vigorous fields in vertebrate paleontology today. A newly described bird from the Jehol Biota of northeast China suggests that scientists have only tapped a small proportion of the birds and dinosaurs that were living at that time, and that the rocks still have many secrets to reveal.* |  | |  |  |  | | S:\SharePassport\Website\Weebly\Science\Img\imscn012412_01_01_web.jpg | [***Weaving electronics into the fabric of our physical world***](#_About_Us)  *Jan. 24, 2012*  *The potential applications for nanophotonics and nanoelectronics are truly startling, suggesting the brink of a revolution in human-machine interfaces that could turn science fiction into a reality.* |  | |  |  |  | |  |
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# SCIENCE

## Tuesday, March 16, 2010

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| |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **Metallic Glass Yields Secrets Under Pressure**  Tuesday, March 16, 2010   |  |  |  |  | | --- | --- | --- | --- | | Credit: Carnegie Institution for Science  Metallic glasses are emerging as potentially useful materials at the frontier of materials science research. They combine the advantages and avoid many of the problems of normal metals and glasses, two classes of materials with a very wide range of applications. For example, metallic glasses are less brittle than ordinary glasses and more resilient than conventional metals.  Metallic glasses also have unique electronic behavior that scientists are just beginning to understand. In a new study, scientists at the Carnegie Institution used high pressure techniques to probe the connection between the  density and electronic structure of a cerium-aluminum metallic glass, opening up new possibilities for developing metallic glasses for specific purposes.  “High pressure is an extremely powerful tool for understanding these materials,” says Ho-kwang Mao of Carnegie’s Geophysical Laboratory, a co-author of the study published in Physical Review Letters. “Pressure can cause changes in their properties, such as their volume or electronic behavior, which in turn tells us about their structure at the atomic scale. The more we know about the structure, the better we can predict their properties and more quickly we can develop new materials.”  Unlike ordinary metallic materials, which have an ordered, crystalline structure, metallic glasses are disordered at the atomic scale. This disorder can actually improve some properties of the material, because boundaries between crystal grains are often sites of weakness, leading to breakage or corrosion. Metallic glasses can therefore have superior strength and durability as compared to other metals. The disordered structure also makes metallic glasses highly efficient magnets because it lacks the kinds of defects found in crystalline metals. | |  |  | | --- | --- | | S:\SharePassport\Website\Weebly\Science\Img\imscn031610_01_01.jpg  Diamond anvil cell used for high-pressure  Experiments   |  | | --- | |  | | |   Density is a property that can be altered by subjecting a material such as glass to high pressure. But unlike other glasses, which reduce their volume under pressure by rearranging their atoms to take up less space, metallic glasses have a structure in which the atoms are already closely packed. For this reason, researchers previously thought that metallic glasses could not be converted into denser phases. But in 2007 two teams made the surprising discovery that cerium-rich metallic glasses did in fact become denser at high pressure. Theorists suggested that the volume collapse happens through changes in the electronic structure of the cerium atoms in which electrons bound to specific atoms under low pressure become “delocalized” (that is, free to move among the atoms) under high pressure. This causes the bond between atoms to shrink, allowing them to pack even more closely. Until now, however, there has been no direct experimental evidence for this transformation.  The research team, led by predoctoral fellow Qiaoshi Zeng of Carnegie’s HPSynC (also a graduate student at Zhejiang University, China) with other co-workers from the Geophysical Laboratory, Zhejiang University, Stanford University and SLAC used a combination of in-situ high pressure synchrotron x-ray absorption spectroscopy and diffraction techniques to observe the electronic transformation in a cerium-aluminum metallic glass (Ce75Al25). The researchers used this glass because its high cerium content made the electronic transformation easier to detect. The experiments showed that at high pressures (between 1.5 and 5 gigapascals, equivalent to 100 to 360 tons per square inch) the volume of the glass decreased by close to 9%. At the same time, x-ray absorption spectra revealed that electrons in the cerium atoms known as 4f electrons did become delocalized, as predicted.  “This result confirms that the volume reduction is due to changes in electronic properties, and shows the key role cerium plays in the phase change.” says Mao. “We may find similar transformations in other densely packed metallic glasses that contain cerium or similar rare earth metals. This is important because with the phase change the glass becomes a new material with new properties. It opens up possibilities for optimizing these materials and for fine-tuning their physical and electronic properties for a variety of applications.”  *Source: Carnegie Institution of Washington* | **Sanwhole**  RSS FEEDS   |  | | --- | |  |   S:\SharePassport\Website\Weebly\Science\Img\rss.png  SANWHOLE  S:\SharePassport\Website\Weebly\Science\Img\rss.png  Science   |  | | --- | |  |   Sanwhole | | | |
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## Thursday, March 25, 2010

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| |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **New Bird Fossil Hints at More Undiscovered Chinese Treasures**  Thursday, March 25, 2010   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Credit: Stephanie Abramowicz, Dinosaur Institute, Natural History Museum of Los Angeles County.  The study of Mesozoic birds and the dinosaur-bird transition is one of the most exciting and vigorous fields in vertebrate paleontology today. A newly described bird from the Jehol Biota of northeast China suggests that scientists have only tapped a small proportion of the birds and dinosaurs that were living at that time, and that the rocks still have many secrets to reveal.  “The study of Mesozoic birds is currently one of the most exciting fields; new discoveries continue to drastically change how we view them,” said Jingmai O’Connor, lead author of the study. The article appeared in the March issue of the Journal of Vertebrate Paleontology.  The new bird, named “Longicrusavis houi,” belongs to a group of birds known as ornithuromorphs (Ornithuromorpha), which are rare in rocks of this age. Ornithuromorphs are more closely related to modern birds than are most of the other birds from the Jehol Biota.  “Longicrusavis adds to the magnificent diversity of ancient birds, many of them sporting teeth, wing claws, and long bony tails, that recently have been unearthed from northeastern China,” said Luis Chiappe, a co-author of the study.  Along with a bird described five years ago, Longicrusavis provides evidence for a new, specialized group of small birds that diversified during the Early Cretaceous between about 130 and 120 million years ago.  “The new discovery adds information not only on the diversity these birds, but also on the possible lakeshore environment in which this bird lived," said co-author Gao Ke-Qin.  The legs of this new species are unusually long, suggesting that it spent much of its time wading in the shallows of ancient lakes. The name “Longicrusavis” means “long-shin bird,” highlighting this important aspect of the new specimen. The presence of ancient birds in this habitat suggests that modern birds might have originated from an ancestor that was adapted for life near rivers and lakes.  Previously undescribed feather impressions from a closely related species suggest that both it and Longicrusavis had a long, fan-shaped tail. These are the oldest species to have such a tail, which likely increased flying performance. The rocks of the Yixian Formation of northeast China have produced a spectacular array of fossils in recent years including fishes, birds, mammals, invertebrates, and dinosaurs. These fossils are collectively are known as the Jehol Biota and they are remarkable because, in many instances, they preserve soft tissues such as feathers or hair in addition to teeth and bones.  “The Jehol Biota never fails to stop giving, and the research to be done on these fossils is virtually endless!” said O’Connor.  About the Society of Vertebrate Paleontology  Founded in 1940 by thirty-four paleontologists, the Society now has more than 2,300 members representing professionals, students, artists, preparators, and others interested in VP. It is organized exclusively for educational and scientific purposes, with the object of advancing the science of vertebrate paleontology. | |  |  | | --- | --- | | S:\SharePassport\Website\Weebly\Science\Img\imscn032410_03_01.jpg  Photograph of part of the holotype specimen of Longicrusavis houi (slab B, PKUP V1069). Although the skeleton is mostly complete (the wings and legs are clearly visible), the head has been detached from the neck and is located between the legs. The beak is pointing toward the left.   |  | | --- | |  |   Credit: Stephanie Abramowicz | | S:\SharePassport\Website\Weebly\Science\Img\imscn032410_03_03.jpg  Life reconstruction of Longicrusavis houi in what was probably its favored habitat, shallow lake waters. A reconstruction of the fossil specimen itself is reflected in the water.   |  | | --- | |  | | |   *Source: Society of Vertebrate Paleontology* | **Sanwhole**  RSS FEEDS   |  | | --- | |  |   S:\SharePassport\Website\Weebly\Science\Img\rss.png  SANWHOLE  S:\SharePassport\Website\Weebly\Science\Img\rss.png  Science   |  | | --- | |  |   Sanwhole | | | |
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## Tuesday, January 24, 2012

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| |  |  |  |  | | --- | --- | --- | --- | | **Weaving electronics into the fabric of our physical world**  Tuesday, January 24, 2012 | **Sanwhole**  RSS FEEDS   |  | | --- | |  |   S:\SharePassport\Website\Weebly\Science\Img\rss.png  SANWHOLE  S:\SharePassport\Website\Weebly\Science\Img\rss.png  Science   |  | | --- | |  |   Sanwhole | | S:\SharePassport\Website\Weebly\Science\Img\imscn012412_01_01_web.jpgCredit: Stephanie Abramowicz, Dinosaur Institute, Natural History Museum of Los Angeles County.  The potential applications for nanophotonics and nanoelectronics are truly startling, suggesting the brink of a revolution in human–machine interfaces that could turn science fiction into a reality. From interactive paper to clothing that generates energy and light-weight material with X-ray capabilities, weaving electronics into the building blocks of everyday materials will undoubtedly impact how we live in the future.  The Electrical Division in the Department of Engineering is leading the charge for Cambridge, both in terms of fundamental research and application within industry. While research is of course essential, of almost equal importance in fields like nanoelectronics is showing real world application, demonstrating the potential of technology to industry through prototyping, and encouraging investment from around the world.  To aid this approach, the University has recently recruited Professor Arokia Nathan from University College London (UCL) to a new Chair of Photonic Systems and Displays. Nathan, a world leader in the development of display technology, will work between the three primary groups in the Electrical Engineering Division (electronic materials, photonics and energy), acting as a conduit and catalyst for ideas and research.  “For me this is a fantastic opportunity to collaborate with researchers at the top of their game, working on this idea of systems that can integrate functionality such as communications and energy into materials to enhance everyday life,” he explained. One of his primary visions for Cambridge is the foundation of a new Design Centre to demonstrate the potential of this technology to industry through prototyping and to encourage investment from around the world.  Initially, Professor Nathan and colleagues within the Division will be developing electronic systems that can be seamlessly layered on to a material or substrate, such as plastic or polyester, with embedded transistors and sensors for transmitting and receiving information. While at UCL, Nathan and a team of collaborators from CENIMAT/FCTUNL, Portugal demonstrated the first inverter and other circuit building blocks on a piece of paper, representing the first step towards animated images and videos on magazine pages.  Power is a vital question for these processes to address. “If a magazine has electronic displays as an integral part of a page, then it’s got to cover its own power,” says Nathan. “Solar energy will be a major focus of the work. I can see it becoming commonplace for clothing to have embedded electronics that generate energy from solar and even body heat, essentially doubling as a battery that can be charging your phone as it’s in your pocket.  This could be coupled with what’s known as ‘green broadcasting’, to build a picture of an individual self-powering their portable electronics as they are out and about. “These portable devices which otherwise lay idle could be sending out information at very low bit rates without using much energy. It could always be active – this is where our photonics group has expertise,” says Nathan. “It’s easy to see how these technologies might appeal to major industry, from clothing manufacturers to publishers, and certainly the military.”  Nanowires will be a key area of investigation for Nathan in the coming years. These structures have an extraordinary length-to-width ratio, only a few nanometres in diameter, and a much greater capacity in terms of speed. “Uniformly dispersed over large areas, the wires could result in millions of transistors on a single sheet of A4 for example,” says Nathan.  “While it hasn’t been done yet, we will be working on this in an attempt to match the speeds of a Pentium-like chip, scaled to A4. Pentium chips cost 10 dollars per centimetre squared, while a nano thin film transistor could cost as little as 10 cents per centimetre squared, a much cheaper alternative.”  Industries such as biomedicine could also benefit hugely from this interlacing of nano-electronics into materials. “You could foresee a time when you can take the X-ray to the patient rather than vice-versa,” says Nathan. “Patients might lie on a surface woven with electronics, so that data can be broadcast straight from the material. You couldn’t do this with Pentium-like chips because of yield and cost issues.”  “With these non-conventional materials you have a great deal of freedom. We believe this approach to circuitry in substrates will lead to the creation of smart substances, and once you start thinking about the possible applications, it’s hard to stop: surgeon’s gloves with smart skin, walls of a house that store energy and generate large-scale displays, magazines with interactive video in the pages, devices that dissolve the toxins in water, bio-interfaces in mobile phones with diagnostic capabilities, clothing that generates energy – the possibilities are endless!”  *Source: University of Cambridge* | | | |
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