

Cathay April 2024

www.cathayradio.org

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Mission: The Cathay Amateur Radio Club is basically an active social club of Ham Radio Operators and their spouses. We support local community requests for HAM emergency communications. Several of us are trained in CPR/ First Aid and are involved with community disaster preparedness.

Monday Night Net Time: 9 PM Local Time/PST, As of 8/21/2023 we are switching over from using Repeater: WB6TCS to **Nick Carsion's Repeater: WA6GEL UHF 444.80000 Mhz, Offset +5Mhz, CTCCS/Tone PL 179.9 Hz on Monument Peak, Milpitas.**

If you cannot reach the fore-mentioned machine, please use WA6GEL UHF 4448.8 Mhz Offset +5Mhz, CTCCS/Tone PL173.8 which is on Mt. San Bruno.

The CARC Monday night net is the best way to find out the latest club news. All check-in are welcome.

Message from the President: George Chong, W6BUR

Hello CARC Members and Friends;

I hope you all had a Happy Easter and were able to come together with family and dear friends.

Many thanks to Nick Cassarino for the use of repeater – WA6GEL for our CARC Monday Night Net.

Additional folks are needed to help out with conducting the CARC radio net on Monday nights. Please contact Ed Fong (edison_fong@hotmail.com) if you are interested.

I wish to thank our CARC members that set aside their valuable time to participate in our Monday night's nets.

Late Breaking News: George Chong President of CARC has passed away on 4/7/2024

Introduction Tech Article:

We benefit from the usefulness of everyday items that literally surround us, these items are created from material science labs.

For example, many of our homes are now lit with LED light bulbs that only went into commercial mass production in early October 1996.

In December 2022 Lawrence Berkeley National Laboratory (Berkeley Lab) and Oak Ridge National Laboratory announced the creation of the world's toughest metallic alloy. The future applications of this new metal alloy is almost endless.

See Tech Article for further information.

CARC Final News Wrap Up

Chat sub s'em to all you CARC members! - George W6BUR.

Public Service Announcements

HAM CRAM / HAM Licensing

For upcoming HAM Licensing locations please refer to:

<http://www.arrl.org/find-an-amateur-radio-license-exam-session>

Auxiliary Communications Service (ACS)

The Auxiliary Communications Service (ACS) is a unit of trained professionals who supply communications support to the agencies of the City and County of San Francisco, particularly during major events/incidents. ACS goals are the support of gathering and

distribution of information necessary to respond to and recover from a disaster.

The ACS Net begins at 1930 hours (7:30 p.m. PT) local time each Thursday evening, on the WA6GG repeater at 442.050 MHz, positive offset, tone 127.3 Hz. The purpose of this net is to practice Net Control skills, practice checking in with deployment status in a formal net, and to share information regarding upcoming ACS events. Guests are welcome to check in. ACS members perform Net Control duty on a regular basis. On the second Thursday of each month, the net is conducted in simplex mode on the output frequency of the WA6GG repeater, 442.050 MHz no offset, tone 127.3 Hz.

ACS holds its General Meetings on the third Tuesday of each month from 1900 hours to 2100 hours local time. Currently meetings are exclusively conducted over Zoom during the COVID-19 pandemic, ACS looks forward to meeting in person again as soon as possible.

Upcoming meeting dates in 2024 are:

- April 16, 2024
- May 21, 2024
- June 18, 2024

Location of in person future ACS meetings are yet to be determined as the regular location is under reconstruction. All interested persons are welcome to attend. For further information contact Corey Siegel KJ6LDJ <kj6ldj@gmail.com>.

For more information, please attend an ACS meeting, check in on the ACS radio net, or call 415-558-2717.

Free Disaster Preparedness Classes In San Francisco – NERT Taught by San Francisco Fire Department (SFFD).

<https://sf-fire.org/nert/nert-calendar-meetings-trainings-events>

Training Classes

TBD

+ Recertifications

TBD

***SFFD DOT** is the Fire Department Division of Training. All participants walking, biking or driving **enter through the driveway gate on 19th St.** between Folsom and Shotwell. Parking is allowed along the back toward the cinderblock wall.

Visit www.sfgov.org/sfdnert to learn more about the training, other locations, and register on line. Upcoming Special NERT Events.

San Francisco Police Department: Auxiliary Law Enforcement Response Team (ALERT)

The Auxiliary Law Enforcement Response Team (ALERT) is a citizen disaster preparedness program designed. The ALERT program is for volunteers 16 years of age or older, who live, work, or attend high school in San Francisco.

Graduates of the San Francisco Police Activities League (P.A.L) Law Enforcement Cadet Academy are also eligible to join.

ALERT volunteers will no longer need to complete the Fire Department's Neighborhood Emergency Response Team (NERT) (www.sfgov.org/sfnert) training and then graduate into two 8 hour Police Department course specifically designed for ALERT team members.

ALERT members will work closely with full-time and/or Reserve Police Officers in the event they are deployed after a disaster. The Basic ALERT volunteer will have no law enforcement powers other than those available to all citizens.

SFPD ALERT Training (New Members)

The next SFPD ALERT training class has been scheduled for: TBD

*Class date indicated are only for new members

IMPORTANT- All participants must complete the background interview process in order to be eligible to attend the ALERT training class.

Eligible ALERT participants may register for a training class by contacting the ALERT Program Coordinator, marina.chacon@sfgov.org, or by telephone at 415-401-4615.

SFPD ALERT Practice/Training Drill

All active/trained ALERT members are asked to join us for our next training drill, via scheduled for on TBD

For more information on the San Francisco Police Department ALERT Program, email us at sfpdalert@sfgov.org, or call Lt. Marina Chacon (SFPD Ret.), SFPD ALERT Program Coordinator, at (415) 401-4615.

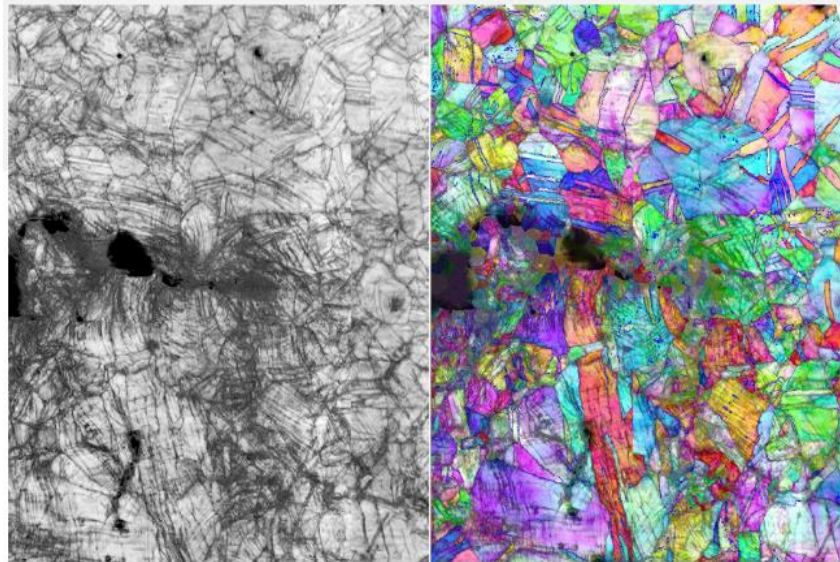
For additional information on the web please refer to:
<https://sfgov.org/policecommission/alert>

Tech Article

Say Hello to the Toughest Material on Earth

By Aliyah Kovner Date: December 8, 2022

[Say Hello to the Toughest Material on Earth - Berkeley Lab – Berkeley Lab News Center \(lbl.gov\)](#)



Microscopy-generated images showing the path of a fracture and accompanying crystal structure deformation in the CrCoNi alloy at nanometer scale during stress testing at 20 kelvin (-424 F). The fracture is propagating from left to right.

(Credit: Robert Ritchie/Berkeley)

A new study reveals the profound properties of a simple metal alloy

Scientists have measured the highest toughness ever recorded, of any material, while investigating a metallic alloy made of chromium, cobalt, and nickel (CrCoNi). Not only is the metal extremely ductile – which, in materials science, means highly malleable – and impressively strong (meaning it resists permanent deformation), its strength and ductility improve as it gets colder. This runs counter to most other materials in existence.

The team, led by researchers from Lawrence Berkeley National Laboratory (Berkeley Lab) and Oak Ridge National Laboratory, [published a study describing their record-breaking findings in Science](#) on Dec. 2, 2022. “When you design structural materials, you want them to be strong but also ductile and resistant to fracture,” said project co-lead Easo George, the Governor’s Chair for Advanced Alloy Theory and Development at ORNL and the University of Tennessee. Typically, it’s a compromise between these

properties. But this material is both, and instead of becoming brittle at low temperatures, it gets tougher.”

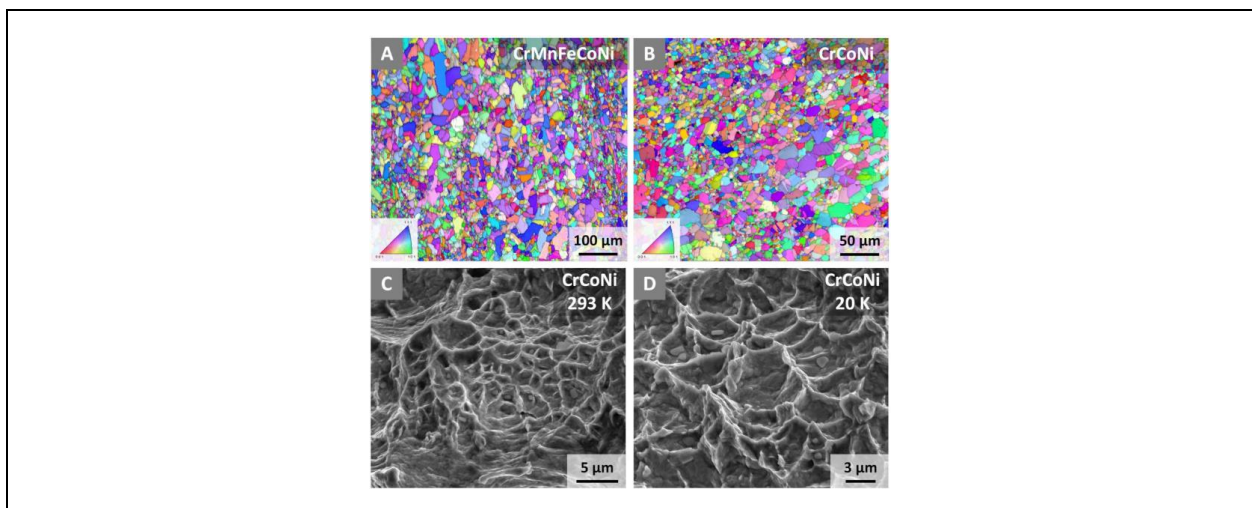
CrCoNi is a subset of a class of metals called high entropy alloys (HEAs). All the alloys in use today contain a high proportion of one element with lower amounts of additional elements added, but HEAs are made of an equal mix of each constituent element. These balanced atomic recipes appear to bestow some of these materials with an extraordinarily high combination of strength and ductility when stressed, which together make up what is termed toughness.

HEAs have been a hot area of research since they were first developed about 20 years ago, but the technology required to push the materials to their limits in extreme tests was not available until recently.

The toughness of this material near liquid helium temperatures (20 kelvin, -424 Fahrenheit) is as high as 500 megapascals square root meters. In the same units, the toughness of a piece of silicon is one, the aluminum airframe in passenger airplanes is about 35, and the toughness of some of the best steels is around 100. So, 500, it’s a staggering number,” said research co-leader Robert Ritchie, a senior faculty scientist in Berkeley Lab’s Materials Sciences Division and the Chua Professor of Engineering at UC Berkeley.

Ritchie and George began experimenting with CrCoNi and another alloy that also contains manganese and iron (CrMnFeCoNi) nearly a decade ago. They created samples of the alloys then lowered the materials to liquid nitrogen temperatures (around 77 kelvin, or -321 F) and [discovered impressive strength and toughness](#).

They immediately wanted to follow up their work with tests at liquid helium temperature ranges, but finding facilities that would enable stress testing samples in such a cold environment, and recruiting team members with the analytical tools and experience needed to analyze what happens in the material at an atomic level took the next 10 years. Thankfully, the results were worth the wait.



These images, generated from scanning electron microscopy, show the grain structures and crystal lattice orientations of (A) CrMnFeCoNi and (B) CrCoNi alloys. (C) and (D) show examples of fractures in CrCoNi at 293 K and 20 K, respectively. (Credit: Robert Ritchie/Berkeley Lab)

Peering into the crystal

Many solid substances, including metals, exist in a crystalline form characterized by a repeating 3D atomic pattern, called a unit cell, that makes up a larger structure called a lattice. The material's strength and toughness, or lack thereof, come from physical properties of the lattice. No crystal is perfect, so the unit cells in a material will inevitably contain "defects, a prominent example being dislocations – boundaries where undeformed lattice meets up with deformed lattice.

When force is applied to the material – think, for example, of bending a metal spoon – the shape change is accomplished by the movement of dislocations through the lattice. The easier it is for the dislocations to move, the softer the material is. But if the movement of the dislocations is blocked by obstacles in the form of lattice irregularities, then more force is required to move the atoms within the dislocation, and the material becomes stronger. On the flip side, obstacles usually make the material more brittle – prone to cracking.

Using neutron diffraction, electron backscatter diffraction, and transmission electron microscopy, Ritchie, George, and their colleagues at Berkeley Lab, the University of Bristol, Rutherford Appleton Laboratory, and the University of New South Wales examined the lattice structures of CrCoNi samples that had been fractured at room temperature and 20 K. (For measuring strength and ductility, a pristine metal specimen is pulled until it fractures, whereas for fracture toughness tests, a sharp crack is intentionally introduced into the sample before it is pulled and the stress needed to grow the crack is then measured.)

The images and atomic maps generated from these techniques revealed that the alloy's toughness is due to a trio of dislocation obstacles that come into effect in a particular order when force is applied to the material. First, moving dislocations cause areas of the crystal to slide away from other areas that are on parallel planes. This movement displaces layers of unit cells so that their pattern no longer matches up in the direction perpendicular to the slipping movement, creating [a type of obstacle](#).

Further force on the metal creates a phenomenon called [nanotwinning](#), wherein areas of the lattice form a mirrored symmetry with a boundary in between. Finally, if forces continue to act on the metal, the energy being put into the system changes the arrangement of the unit cells themselves, with the CrCoNi atoms switching from a [face-centered cubic](#) crystal to another arrangement known as hexagonal close packing. This sequence of atomic interactions ensures that the metal keeps flowing, but also keeps meeting new resistance from obstacles far past the point that most materials snap from the strain. "So as you are pulling it, the first mechanism starts and then the second one starts, and then the third one starts, and then the fourth," explained Ritchie. "Now, a lot of people will say, well, we've seen nanotwinning in regular

materials, we've seen slip in regular materials. That's true. There's nothing new about that, but it's the fact they all occur in this magical sequence that gives us these really tremendous properties."

The team's new findings, taken with other recent work on HEAs, may force the materials science community to reconsider long-held notions about how physical characteristics give rise to performance. "It's amusing because metallurgists say that the structure of a material defines its properties, but the structure of the NiCoCr is the simplest you can imagine – it's just grains," said Ritchie. "However, when you deform it, the structure becomes very complicated, and this shift helps explain its exceptional resistance to fracture," added co-author Andrew Minor, director of the [National Center of Electron Microscopy](#) facility of the Molecular Foundry at Berkeley Lab and Professor of Materials Science and Engineering at UC Berkeley. "We were able to visualize this unexpected transformation due to the development of fast electron detectors in our electron microscopes, which allow us to discern between different types of crystals and quantify the defects inside them at the resolution of a single nanometer – the width of just a few atoms – which as it turns out, is about the size of the defects in deformed NiCoCr structure."

The CrMnFeCoNi alloy was also tested at 20 kelvin and performed impressively, but didn't achieve the same toughness as the simpler CrCoNi alloy.

Forging new products

Now that the inner workings of the CrCoNi alloy are better understood, it and other HEAs are one step closer to adoption for special applications. Though these materials are expensive to create, George foresees uses in situations where environmental extremes could destroy standard metallic alloys, such as in the frigid temperatures of deep space. He and his team at Oak Ridge are also investigating how alloys made of more abundant and less expensive elements – there is a global shortage of cobalt and nickel due to their demand in the battery industry – could be coaxed into having similar properties.

Though the progress is exciting, Ritchie warns that real-world use could still be a ways off, for good reason. "When you are flying on an airplane, would you like to know that what saves you from falling 40,000 feet is an airframe alloy that was only developed a few months ago? Or would you want the materials to be mature and well understood? That's why structural materials can take many years, even decades, to get into real use."

This research was supported by the Department of Energy's Office of Science. The low-temperature mechanical testing and neutron diffraction was performed at the ENGIN-X ISIS Facility at the Rutherford Appleton Laboratory, led by first author Dong Liu. Microscopy was performed at the National Center for Electron Microscopy at the Molecular Foundry, a DOE Office of Science user facility at Berkeley Lab. The other authors on this project were Qin Yu, Saurabh Kabra, Ming Jiang, Joachim-Paul Forna-

Kreutzer, Ruopeng Zhang, Madelyn Payne, Flynn Walsh, Bernd Gludovatz, and Mark Asta.