

NC State breakthrough results in super-hard nanocrystalline iron that can take the heat

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Researchers at North Carolina State University have created a substance far stronger and harder than conventional iron, and which retains these properties under extremely high temperatures – opening the door to a wide variety of potential applications, such as engine components that are exposed to high stress and high temperatures.

Iron that is made up of nanoscale crystals is far stronger and harder than its traditional counterpart, but the benefits of this “nano-iron” have been limited by the fact that its nanocrystalline structure breaks down at relatively modest temperatures. But the NC State researchers have developed an iron-zirconium alloy that retains its nanocrystalline structures at temperatures above 1,300 degrees Celsius – approaching the melting point of iron.

Kris Darling, a Ph.D. student at NC State who led the project to develop the material, explains that the alloy’s ability to retain its nanocrystalline structure under high temperatures will allow for the material to be developed in bulk, because conventional methods of materials manufacture rely on heat and pressure.

In addition, Darling says the ability to work with the material at high temperatures will make it easier to form the alloy into useful shapes – for use as tools or in structural applications, such as engine parts.

The new alloy is also economically viable, since “it costs virtually the same amount to produce the alloy” as it does to create nano-iron, Darling

says.

Dr. Carl C. Koch, an NC State professor of materials science engineering who worked on the project, explains that the alloy essentially consists of 1 percent zirconium and 99 percent iron. The zirconium allows the alloy to retain its nanocrystalline structure under high temperatures.

Source: North Carolina State University

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