ZIRCON IN TECHNOLOGY AND EVERYDAY LIFE

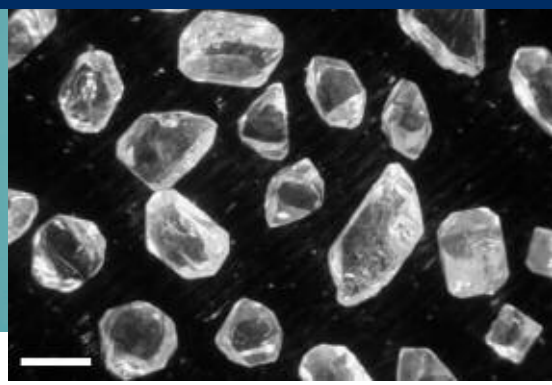
The pages of this issue provide a glimpse into the scientific uses and advantages of zircon, which are both numerous and remarkable. This extraordinary mineral is also valued for more worldly reasons. Because of its high refractive index (~1.95) and dispersion (giving it brilliance and "fire"), zircon was used as a substitute for diamond before the manufacture of cubic zirconia. Clear zircons are not uncommon, and colored varieties include yellow (hyacinth), orange, red, pink, green, brown, black, grey, and blue, the last of which is an alternative to topaz as the birthstone for December. In medieval times, zircon was believed to cure diseases, protect from poisons, induce sleep, and aid digestion (in some modern-day researchers it has *caused* insomnia and indigestion). Today, the main sources of gem-quality zircon are Australia, Cambodia, Myanmar, Sri Lanka, and Thailand.

Zircon is the primary source of zirconium oxide (ZrO_2; zirconia), which was first isolated from zircon in 1789 (the reduced metal was not produced until 1824 because of the tenacity with which Zr forms bonds with both oxygen and nitrogen). Zirconia is used as a commercial refractory for furnace linings: porous, ZrO_2-based ceramics make outstanding thermal insulators. Zirconia is also used as a container for melting high-temperature glasses and metals such as platinum. Zircon itself has been slip-cast as dense, refractory bricks for applications requiring strength, chemical durability, and temperature resistance, and has even served as a container in experimental petrology (see photos). This versatile mineral has also been proposed as a radioactive waste form for transuranic elements (see *Elements*, volume 2, issue 6). At atmospheric pressure, zircon breaks down to ZrO_2 and SiO_2 at ~1660°C. Together these oxides melt in eutectic fashion at ~1690°C; the melting point of ZrO_2 by itself is ~2700°C.

Zirconium metal is used in a number of technological applications, perhaps most importantly in the cladding of uranium oxide fuel rods in nuclear reactors, where its corrosion resistance, mechanical strength and very low cross-section for thermal neutrons make it advantageous over all other metals. Added to niobium, Zr forms a superconducting alloy. Zirconium (and hafnium) fluoride glasses are used in the core and cladding of infrared (IR) guide fibers because of their extremely high transmission in the IR region.

E. Bruce Watson

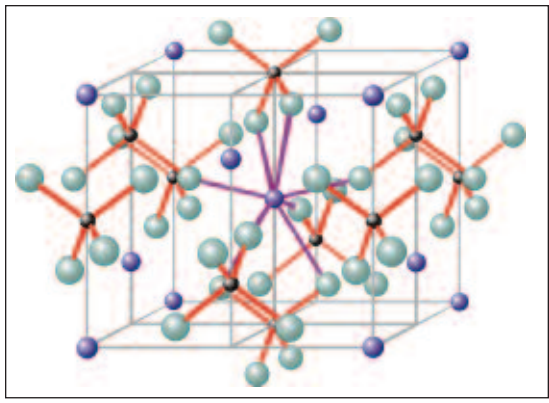
Faceted zircon crystals from Sri Lanka and Thailand, ranging in weight from 7.76 to 40.19 carats. TOP INSERT: Zircon, Kandy, Sri Lanka. Brilliant-cut, heat-treated, 208.65 cts. (largest fine gem zircon: AMNH42724). PHOTO COURTESY AMERICAN MUSEUM OF NATURAL HISTORY / VAN PELT PHOTOGRAPHERS.



Synthetic zircon crystals grown from $PbO–SiO_2$ melt (scale bar is 200 microns)

Polycrystalline zircon brick

Polycrystalline zircon capsules containing quenched basaltic melt



Zircon structure (by EBW)