


Cerium - Ce

Chemical properties of cerium - Health effects of cerium - Environmental effects of cerium

Atomic number	58	
Atomic mass	140.12 g.mol ⁻¹	
Electronegativity according to Pauling	1.1	
Density	6.76 g.cm ⁻³ at 20°C	
Melting point	799 °C	
Boiling point	3426 °C	
Vanderwaals radius	0.181 nm	
Ionic radius	0.102 nm (+3) ; 0,087 nm (+4)	
Isotopes	9	
Electronic shell	[Xe] 4f ¹ 5d ¹ 6s ²	
Energy of first ionisation	526.8 kJ.mol ⁻¹	
Energy of second ionisation	1045 kJ.mol ⁻¹	
Energy of third ionisation	1945.6 kJ.mol ⁻¹	
Energy of fourth ionisation	3537 kJ.mol ⁻¹	
Standard Potential	- 2.48 V (Ce ³⁺ / Ce)	
Discovered by	W. von Hisinger in 1903	

Cerium

Cerium is a malleable, soft, ductile, iron-grey metal, slightly harder than lead. It is very reactive: it tarnishes readily in the air, it oxidizes slowly in cold water and rapidly in hot water. It dissolves in acids. It can burn when heated or scratched with a knife.

Applications

The metal is used as a core for the carbon electrodes of arc lamps, for incandescent mantles for gas lighting. Cerium is used in aluminium and iron alloys, in stainless steel as a precipitation hardening agent, to make permanent magnets. Cerium oxide is part of the catalyst of catalytic converters used to clean up exhaust vehicles, it also catalyzes the reduction of [nitrogen](#) oxides (NO_x) to nitrogen gas. All new cars are now equipped with catalytic converter which consist in a ceramic or metal substrate, a coating of aluminium and cerium oxides and a layer of finely dispersed metal such as [platinum](#) or [rhodium](#), which is the active surface.

Cerium sulphide (Ce₂S₃) is likely to replace cadmium in red pigments for containers, toys, household wares and crates, since cadmium is now considered environmentally undesirable. Other uses of cerium are in flat-screen televisions, low-energy light bulbs and magnetic-optic compact discs, in chromium plating. The use of cerium is still growing, due to the fact that it is suited to produce catalysts and to polish glass.

Cerium in the environment

Cerium is the most abundant of the rare earth elements. It makes up about 0.0046 % of the Earth's crust by weight. Cerium comes mainly from the major lanthanide ores but some is obtained from perovskite, a titanium mineral and allanite, both of which can have enough cerium to make them viable sources. Production amounts to 23.000 tonnes a year, but this amount is likely to increase since more and more cerium is used nowadays.

Health effects of cerium

Cerium is one of the rare chemicals, that can be found in houses in equipment such as colour televisions, fluorescent lamps, energy-saving lamps and glasses. All rare chemicals have comparable properties.

Cerium is mostly dangerous in the working environment, due to the fact that fumes and gasses can be inhaled with air. This can cause lung embolisms, especially during long-term exposure. Cerium can be a threat to the liver when it accumulates in the human body.

Cerium has no known biological role, but it has been noted that cerium salts stimulate metabolism.

Environmental effects of cerium

Cerium is dumped in the environment in many different places, mainly by petrol-producing industries. It can also enter the environment when household equipment is thrown away. Cerium will gradually accumulate in soils and water soils and this will eventually lead to increasing concentrations in humans, animals and soil particles.

With water animals cerium causes damage to cell membranes, which has several negative influences on reproduction and on the functions of the nervous system.

Thanks to its use in catalytic converters cerium is slowly improving the atmosphere of cities, or wherever diesel engines operate. Diesel engines emit particulates, carbon particles only a few micrometers in diameter. One way to reduce particulate emissions is to trap them in a ceramic filter and then burn them off. If a little cerium oxide is added to the fuel itself, it will catalyze the burning of the particulates and eliminate them.