DOWNLOAD PDF PHYSICAL PROPERTIES OF ZINC OXIDE

Chapter 1 : zinc | Properties, Uses, & Facts | racedaydvl.com

Zinc oxide is an inorganic compound with the formula ZnO. ZnO is a white powder that is insoluble in water, and it is widely used as an additive in numerous materials and products including rubbers, plastics, ceramics, glass, cement, lubricants, paints, ointments, adhesives, sealants, pigments, foods, batteries, ferrites, fire retardants, and first-aid tapes.

February 2, , Polish Academy of Sciences The zinc oxide nanocrystals produced from organometallic compounds are safe: They seem to be safe for humans, but there are still no standards for their toxicity, and despite investigations, the toxicological impact of ZnO nanomaterials remains ambiguous. Researchers from the Polish Academy of Sciences IPC PAS in Warsaw and the Warsaw University of Technology PW have recently developed a method for producing defect-free ZnO quantum dots with enduring physicochemical properties such as monodispersity, a relatively high quantum efficiency, record-long luminescence lifetimes and EPR silence under standard conditions. The tightly coordinated and impermeable organic shells that stabilize the surface make the new ZnO quantum dots resistant to both chemical and biological environments. Moreover, until now, only short ZnO photoluminescence decays have been observed, on the order of a few to a dozen or so picoseconds, characteristic for sol-gel nanoparticles, or slightly longer, nanosecond ones, typical only for ZnO monocrystals. In an article published in Chemistry - A European Journal, the Warsaw scientists, in collaboration with a group from the Jagiellonian University in Cracow, showed that their zinc oxide nanoparticles are safe. The research could lead to rapid introduction of the new ZnO quantum dots for biological and medical laboratories and other applications. ZnO nanocrystals manufactured in a classic manner by the sol-gel method are not well stabilized or isolated from the environment. For example, interactions that occur at the interface between the inorganic ZnO core and the biological environment can lead to the generation of reactive oxygen species or the dissolution and release of potentially toxic zinc cations. However, many toxicological studies of ZnO concern nanoparticles that are heterogeneous in size and also too large to be able to penetrate into cells. We also realized that in practice, many of the characteristics of nanoparticles depend not only on their size, but also on the surface properties of both the nanocrystalline ZnO and the organic stabilizing layer. Therefore, we decided to modify our one-pot, self-supporting organometallic method of synthesis, so that the ZnO nanoparticles produced behave as neutrally as possible in the interior of the cells," says Dr. For biological applications, the end result is stable, spherical nanoparticles consisting of a crystalline ZnO core with a diameter of four to five nanometres surrounded by a shell of organic ligands. This shell increases the size of the nanoparticles their hydrodynamic diameter is about 12 nm and protects the inorganic core from degradation due to interaction with what is often a very reactive biological environment, while eliminating the influence of ZnO itself on this environment. Such particles are considered to be potentially the most toxic. Interestingly, these ZnO nanoparticles showed extremely low harmful effects in in vitro model tests. The recent results, as well as the studies carried out simultaneously in the parent team, provided further evidence of the unique character of the nanocrystalline ZnO obtained as a result of the transformation of organometallic molecular precursors," notes Dr. However, there are concerns about their biological and environmental impacts. Nanoparticles can enter the bodyâ€”the respiratory tract is frequently exposed to elevated concentrations of nanomaterials is particularly vulnerable to toxicity. Therefore, A and MRC-5 cell lines were selected as in vitro models for internal malignancies and normal lung cells, respectively. Researchers from the IPC PAS and PW showed that the organic layer surrounding the improved nanoparticles is impermeableâ€”zinc ions are not released into the environment, and reactive oxygen species are not formed. Even at high concentrations, the toxicity of the new ZnO nanoparticles turned out to be negligible. So we have a strong foundation on which to start working on their applications. Not only in medical imaging, but also in other areas in which nanoparticles could potentially interact with the human body, for example, as one of the components of paint. We are also developing a new technology for the synthesis of ZnO quantum dots and searching for potential applications as a part of NANOXO, a start-up company," summarizes Prof.

Chapter 2 : Zinc - Wikipedia

Zinc oxide and the other most common physical sunscreen, titanium dioxide, are considered to be nonirritating, nonallergenic, and non-comedogenic. Zinc from zinc oxide is, however, slightly absorbed into the skin.

Check new design of our homepage! Chemical Properties of Zinc Zinc is a metallic chemical element and is quite active chemically. In this article, you will get some relevant information about chemical properties of zinc metal. ScienceStruck Staff Last Updated: Dec 10, The compounds and alloys of zinc were known to mankind since ancient times. However, the properties of the metal were first described by Paracelsus Aracelsus, a Swiss-born German alchemist in the early part of the 16th century. However, he was not aware of the exact composition of the metal. For this reason, many people feel that the credit for discovering zinc should go to German chemist, Andreas Marggraf as he isolated the pure form of the metal in Basic Facts about Zinc In its pure form, zinc metal is lustrous, bluish gray in color. It is mostly extracted from its ore, zinc blende or sphalerite, which is a sulfide form of zinc. This ore is abundantly available on the surface of the earth. Large deposits of this ore are found in various parts of Asia, Australia and the United States. In chemistry, the element zinc is considered as a transition metal and is represented with the symbol Zn. Like other transition metals, it is a d-block element in the periodic table. Here, it is placed in the fourth period and twelfth group. It is in the same group as cadmium and mercury. What are the Chemical Properties of Zinc? The chemical properties exhibited by an element are governed by the properties of its atoms. Let us take a look at some of the atomic properties of zinc: As you can see from the electronic configuration of zinc, it is bivalent in nature as it has two electrons in its outermost shell or the valence shell. During a chemical reaction, it has a tendency to form a covalent bond. For this reason, chemical properties of zinc and magnesium have got lots of similarities. This metal does not react with atmospheric air in absence of moisture. However, when it comes in contact with the moist air, then its surface gets tarnished easily. This is because its outer layer reacts with carbon dioxide present in the air to form zinc carbonate Zn5 OH 6 CO3 2. This thin and tarnished coat is referred to as passivation layer and is formed to provide protection to its underlying surface from air and water. When pure zinc metal is burnt in air, then it gives out a bright bluish green flame and gaseous form of zinc oxide is obtained in the process. At room temperature, pure form of zinc usually does not react with weak or dilute acids because of the presence of passivation layer on its surface. However, if it comes in contact with concentrated form of strong acids like hydrochloric acid, then it undergoes a slow chemical reaction and hydrogen gas is released. The acids first dissolve the protective layer on zinc and then the reaction with the metal starts. However, these acids can corrode zinc faster, if it has trace amounts of nickel salts in them. At normal room temperature, zinc does not react with gaseous form of halogens like chlorine or fluorine. If it is exposed to these gases at a higher temperature, then zinc halides are formed. When zinc salts are dissolved in water, then they undergo hydrolysis to form zinc hydroxide Zn OH 2 , which is insoluble in water and forms precipitates. Moreover, this hydroxide is amphoteric in nature, which means that it has both acidic and basic properties. All these properties are utilized in various uses and applications of zinc. One key application of zinc is in galvanizing metals. In the galvanization process, iron and steel are coated with a layer of zinc to protect the surface from corrosion or rusting. It is also used in batteries and helps to remove water impurities. Due to all these important usage, zinc is considered as one of the most valuable metals.

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Chapter 3 : Zinc - Element information, properties and uses | Periodic Table

Zinc oxide is an inorganic compound with the formula ZnO. It is a white powder that is insoluble in water. ZnO is present in the Earth's crust as the mineral zincite. That being said, most ZnO used commercially is synthetic. Zinc oxide is commonly found in medical ointments where it used to treat.

A zincblende unit cell Structure Zinc oxide crystallizes in two main forms , hexagonal wurtzite [17] and cubic zincblende. The wurtzite structure is most stable at ambient conditions and thus most common. The zincblende form can be stabilized by growing ZnO on substrates with cubic lattice structure. In both cases, the zinc and oxide centers are tetrahedral , the most characteristic geometry for Zn II. ZnO converts to the rocksalt motif at relatively high pressures about 10 GPa. This and other lattice symmetry properties result in piezoelectricity of the hexagonal and zincblende ZnO, and pyroelectricity of hexagonal ZnO. This property accounts for the preferential formation of wurtzite rather than zinc blende structure, [19] as well as the strong piezoelectricity of ZnO. Because of the polar Zn-O bonds, zinc and oxygen planes are electrically charged. To maintain electrical neutrality, those planes reconstruct at atomic level in most relative materials, but not in ZnO â€" its surfaces are atomically flat, stable and exhibit no reconstruction. This anomaly of ZnO is not fully explained. Mechanical properties ZnO is a relatively soft material with approximate hardness of 4. The high heat capacity and heat conductivity, low thermal expansion and high melting temperature of ZnO are beneficial for ceramics. Advantages associated with a large band gap include higher breakdown voltages, ability to sustain large electric fields, lower electronic noise , and high-temperature and high-power operation. Nonstoichiometry is typically the origin of n-type character, but the subject remains controversial. This problem originates from low solubility of p-type dopants and their compensation by abundant n-type impurities. This problem is observed with GaN and ZnSe. Measurement of p-type in "intrinsically" n-type material is complicated by the inhomogeneity of samples. However, many of these form deep acceptors and do not produce significant p-type conduction at room temperature. Zinc smelting For industrial use, ZnO is produced at levels of tons per year [8] by three main processes: Zinc vapor reacts with the oxygen in the air to give ZnO, accompanied by a drop in its temperature and bright luminescence. Zinc oxide particles are transported into a cooling duct and collected in a bag house. This indirect method was popularized by LeClaire France in and therefore is commonly known as the French process. Its product normally consists of agglomerated zinc oxide particles with an average size of 0. Direct process The direct or American process starts with diverse contaminated zinc composites, such as zinc ores or smelter by-products. The zinc precursors are reduced carbothermal reduction by heating with a source of carbon such as anthracite to produce zinc vapor, which is then oxidized as in the indirect process. Because of the lower purity of the source material, the final product is also of lower quality in the direct process as compared to the indirect one. Wet chemical process A small amount of industrial production involves wet chemical processes, which start with aqueous solutions of zinc salts, from which zinc carbonate or zinc hydroxide is precipitated. Laboratory synthesis The red and green colors of these synthetic ZnO crystals result from different concentrations of oxygen vacancies. Large single crystals many cubic centimeters can be grown by the gas transport vapor-phase deposition , hydrothermal synthesis , [20] [33] [34] or melt growth. Growth by gas transport is difficult to control, leaving the hydrothermal method as a preference. Ordinary white powdered zinc oxide can be produced in the laboratory by electrolyzing a solution of sodium bicarbonate with a zinc anode. Zinc hydroxide and hydrogen gas are produced. The zinc hydroxide upon heating decomposes to zinc oxide. Nanostructures can be obtained with most above-mentioned techniques, at certain conditions, and also with the vapor-liquid-solid method. Certain additives, such as polyethylene glycol or polyethylenimine, can improve the aspect ratio of the ZnO nanowires. Common pre-seeding methods include in-situ thermal decomposition of zinc acetate crystallites, spincoating of ZnO nanoparticles and the use of physical vapor deposition methods to deposit ZnO thin films. Aligned ZnO nanowires can be used in dye-sensitized solar cells and field emission devices. The use of pushpanjan, probably zinc oxide, as a salve for eyes and open wounds, is mentioned in the Indian medical text the Charaka Samhita , thought to date from BC or before.

Zinc oxide is no longer used for treating skin cancer, though it is still used as an ingredient in products such as baby powder and creams against diaper rashes , calamine cream, anti- dandruff shampoos , and antiseptic ointments. This liberated metallic zinc as a vapor, which then ascended the flue and condensed as the oxide. This process was described by Dioscorides in the 1st century AD. This was presumably also made in the same way and used to produce brass. From India, zinc manufacture moved to China in the 17th century. In , the first European zinc smelter was established in Bristol , United Kingdom. Zinc white was accepted as a pigment in oil paintings by but it did not mix well with oil. This problem was solved by optimizing the synthesis of ZnO. In , LeClaire in Paris was producing the oil paint on a large scale, and by , zinc white was being manufactured throughout Europe. The success of zinc white paint was due to its advantages over the traditional white lead: Because zinc white is so "clean" it is valuable for making tints with other colors, but it makes a rather brittle dry film when unmixed with other colors. For example, during the late s and early s, some artists used zinc white as a ground for their oil paintings. All those paintings developed cracks over the years. In the s, the second largest application of ZnO was photocopying. High-quality ZnO produced by the "French process" was added to photocopying paper as a filler. This application was soon displaced by titanium. Most applications exploit the reactivity of the oxide as a precursor to other zinc compounds. For material science applications, zinc oxide has high refractive index , high thermal conductivity, binding, antibacterial and UV-protection properties. Consequently, it is added into materials and products including plastics, ceramics, glass, cement, [53] rubber, lubricants, [5] paints, ointments, adhesive, sealants, concrete manufacturing, pigments, foods, batteries, ferrites, fire retardants, etc. Ceramic industry Ceramic industry consumes a significant amount of zinc oxide, in particular in ceramic glaze and frit compositions. The relatively high heat capacity, thermal conductivity and high temperature stability of ZnO coupled with a comparatively low coefficient of expansion are desirable properties in the production of ceramics. ZnO affects the melting point and optical properties of the glazes, enamels, and ceramic formulations. Zinc oxide as a low expansion, secondary flux improves the elasticity of glazes by reducing the change in viscosity as a function of temperature and helps prevent crazing and shivering. Zinc in small amounts improves the development of glossy and brilliant surfaces. However, in moderate to high amounts, it produces matte and crystalline surfaces. With regard to color, zinc has a complicated influence. Two minerals, zincite and hemimorphite , have been historically called calamine. When mixed with eugenol , a ligand , zinc oxide eugenol is formed, which has applications as a restorative and prosthodontic in dentistry. Zinc oxide is widely used to treat a variety of skin conditions, including dermatitis, itching due to eczema, diaper rash and acne. It is used in products such as baby powder and barrier creams to treat diaper rashes , calamine cream, anti- dandruff shampoos , and antiseptic ointments. Zinc oxide and the other most common physical sunscreen , titanium dioxide , are considered to be nonirritating, nonallergenic, and non- comedogenic. There has been concern that they might be absorbed into the skin. The enhancing effect of this nanomaterial is concentration dependent against all test strains. This effect may be due to two reasons. First, zinc oxide nanoparticles can interfere with NorA protein, which is developed for conferring resistance in bacteria and has pumping activity that mediate the effluxing of hydrophilic fluoroquinolones from a cell. Second, zinc oxide nanoparticles can interfere with Omf protein, which is responsible for the permeation of quinolone antibiotics into the cell. A filter consisting of charcoal impregnated with zinc oxide and iron oxide removes significant amounts of hydrogen cyanide HCN and hydrogen sulfide H2S from tobacco smoke without affecting its flavor. Zinc sulfate is also used for the same purpose. Some prepackaged foods also include trace amounts of ZnO even if it is not intended as a nutrient. Zinc oxide was linked to dioxin contamination in pork exports in the Chilean pork crisis. The contamination was found to be due to dioxin contaminated zinc oxide used in pig feed. The use of zinc white zinc oxide as a pigment in oil painting started in the middle of 18th century. It is also a main ingredient of mineral makeup CI
They are especially effective for galvanized iron. Iron is difficult to protect because its reactivity with organic coatings leads to brittleness and lack of adhesion. Zinc oxide paints retain their flexibility and adherence on such surfaces for many years. Al coatings are used for energy-saving or heat-protecting windows. The coating lets the visible part of the spectrum in but either reflects the infrared IR radiation back into the room energy saving or does not let the IR radiation into the room heat protection , depending on which side of the window

has the coating. The coating reduces the diffusion of oxygen with PEN. The coating protects PC from solar radiation and decreases the oxidation rate and photo-yellowing of PC. The depletion is necessary, because 64Zn is transformed into radioactive 65Zn under irradiation by the reactor neutrons. Therefore, its most common potential applications are in laser diodes and light emitting diodes LEDs. For instance as transparent conducting oxide layer and ZnO nanostructures provide better light outcoupling. ZnO is the most promising candidate in the field of random lasers to produce an electronically pumped UV laser source. The pointed tips of ZnO nanorods result in a strong enhancement of an electric field. Therefore, they can be used as field emitters. The constituents Zn and Al are much cheaper and less toxic compared to the generally used indium tin oxide ITO. One application which has begun to be commercially available is the use of ZnO as the front contact for solar cells or of liquid crystal displays. As field-effect transistors, they even may not need a pâ€”n junction, [98] thus avoiding the p-type doping problem of ZnO. Some of the field-effect transistors even use ZnO nanorods as conducting channels. Selectivity to hydrogen gas was achieved by sputtering Pd clusters on the nanorod surface.

Chapter 4 : New, safe zinc oxide quantum dots

Zinc oxide (ZnO) nanopowders are available as powders and dispersions. These nanoparticles exhibit antibacterial, anti-corrosive, antifungal and UV filtering properties. Zinc is a Block D, Period 4 element while Oxygen is a Block P, Period 2 element.

Galvanizing is the process of laying down a thin layer of zinc on the surface of a second metal. Zinc does not corrode rust as easily as iron and other metals. So the thin layer of zinc protects iron and other metals from corrosion. Discovery and naming Some metals can be obtained from their ores easily. In a few cases, all that is needed is to heat the ore. Heating an ore of zinc releases the free metal. But with zinc, there is an additional problem. Zinc metal sublimates very easily. Sublimation is the process by which a solid changes directly to a gas when heated, without first changing to a liquid. Anyone who wanted to make zinc from its ore would lose the zinc almost immediately by sublimation. Of course, early people did not understand this process. They may very well have made zinc by heating its ores. But any zinc they made would have floated away immediately. Still, a process for extracting zinc from its ores was apparently invented in India by the 13th century. The process involves heating the zinc ore in a closed container. When zinc vapor forms, it condenses inside the container. It can then be scraped off and used. That method seems to have been passed to China and then, later, to Europe. In the meantime, ancient people were familiar with compounds and alloys of zinc. For example, there are brass objects from Palestine dating to B. Brass is an alloy of copper and zinc. The alloy may have been made by humans or found naturally in the earth. No one knows the origin of the brass in these objects. The first European to describe zinc was probably Swiss physician Paracelsus Early in life, he took the name Paracelsus, meaning "greater than Celsus. Paracelsus wanted the world to know that he was even "greater than Celsus. Alchemy was a kind of pre-science that existed from about B. People who studied alchemyâ€”alchemistsâ€”wanted to find a way to change lead, iron, and other metals into gold. They were also looking for the "secret to eternal life. But it developed a number of techniques and produced many new materials that were later found to be useful in modem chemistry. Paracelsus first wrote about zinc in the early s. He described some properties of the metal. But he said he did not know what the metal was made of. Because of his report on the metal, Paracelsus is sometimes called the discoverer of zinc. The name zinc was first used in It comes from the German name for the element, Zink. What meaning that word originally had is not known. Physical properties Zinc is a bluish-white metal with a shiny surface. It is neither ductile nor malleable at room temperature. Ductile means capable of being drawn into thin wires. Malleable means capable of being hammered into thin sheets. Its density is 7. Zinc is a fairly soft metal. Its hardness is 2. The Mohs scale is a way of expressing the hardness of a material. It runs from 0 for talc to 10 for diamond. Chemical properties Zinc is a fairly active element. It dissolves in both acids and alkalis. An alkali is a chemical with properties opposite those of an acid. Sodium hydroxide "common lye" and limewater are examples of alkalis. Zinc does not react with oxygen in dry air. In moist air, however, it reacts to form zinc carbonate. The zinc carbonate forms a thin white crust on the surface which prevents further reaction. Zinc burns in air with a bluish flame. That places the element about number 24 on the list of the elements in terms of their abundance. A process for extracting zinc from its ores was apparently invented in India by the 13th century. Zinc never occurs as a free element in the earth. The largest producer of zinc ore in the world today is Canada. In the United States, more than half of the zinc produced comes from Alaska. Isotopes Five naturally occurring isotopes of zinc are known. They are zinc, zinc, zinc, zinc, and zinc Isotopes are two or more forms of an element. Isotopes differ from each other according to their mass number. The mass number represents the number of protons plus neutrons in the nucleus of an atom of the element. The number of protons determines the element, but the number of neutrons in the atom of any one element can vary. Each variation is an isotope. About eight radioactive isotopes of zinc are known also. A radioactive isotope is one that breaks apart and gives off some form of radiation. Radioactive isotopes are produced when very small particles are fired at atoms. These particles stick in the atoms and make them radioactive. One radioactive isotope of zinc, zinc, has some practical importance. Zinc is used as a tracer to study physical and biological events. A tracer is an isotope whose presence in a system can easily be detected. The isotope is injected into the system at some point. Inside the system, the isotope gives off radiation. That radiation can be followed by means of detectors placed around the system. For example, zinc is used to study how alloys wear out. An alloy can be made using zinc metal. But the zinc used is zinc instead of ordinary zinc. Changes in radiation given off by the radioactive isotope can be followed to find patterns in the way the alloy wears out. Zinc can also be used to study the role of zinc in the human body. A person can be fed food that contains a small amount of zinc The movement of the isotope through the body can be followed with a detector. A researcher can see where the isotope goes and what roles it plays in the body. This compound is used to produce textiles, storage batteries, paints, and rubber products. Extraction As with many metals, pure zinc can be prepared from an ore by one of two methods. First, the ore can be roasted heated in air. Roasting converts the ore to a compound of zinc and oxygen, zinc oxide ZnO. The compound can then be heated with charcoal pure carbon. The carbon takes the oxygen away from the zinc, leaving the pure metal behind: The other method is to pass an electric current through a compound of zinc. The electric current causes the compound to break apart. Pure zinc metal is produced. This is money lost when metals become corroded and break apart. Buildings and The pipes of this beautiful church organ are made of zinc alloys. It is hardly surprising that protecting metal from corrosion is an important objective in American industry. One of the most effective ways of providing protection is through galvanizing. Today, about half of all the zinc produced in the United States is used to galvanize other metals. The largest consumers of galvanized metal are the construction and automotive industries.

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Chapter 5 : Physical properties of metal-doped zinc oxide films for surface acoustic wave application

Zinc metal tarnishes in mosit air and burns in air to form the white zinc oxide 3. It is a fair electrical conductor and will react with dilute acids to release hydrogen.

In the case of diaper rash, zinc can be used frequently even of delicate skin to lower inflammation. Helps Prevent Bacterial Infections With the ability to act like a mild astringent, zinc oxide can help keep harmful bacteria from causing infections of the skin, and act as a natural skin-drying agent. Traditional uses of zinc oxide products included treating wounds following surgery and applying salves inside the mouth to treat ulcers or sores. As an added benefit, just like other commercial or beauty astringent products, zinc oxide helps to minimize the appearance of large pores and prevents shininess of the skin by regulating oil production. The body requires zinc and other trace minerals for the synthesis of collagen that helps to build and repair connective tissue. Zinc can also help increase the amount of other active ingredients that are absorbed into the skin when its used in conjunction with other anti-aging products. From the s through about the s, zinc oxide products were used primarily to treat skin conditions unrelated to sun exposure, including poison ivy, dandruff, and rashes. How to Use Zinc Oxide: When it comes to purchasing sunscreens, read ingredients carefully and look for the words zinc oxide which means the product has broad-spectrum blocking abilities. Other tips for using zinc oxide sunscreen for preventing sunburns? Use about 2 tablespoons at a time for a homemade cream or lotion that you can store for later use see below for DIY recipe. Zinc Oxide Creams or Ointments: You can use a bandage on top of zinc oxide cream, or leave the cream exposed to air to dry. Apply cream before putting on a new diaper, prior to bedtime, or if you notice signs of a rash when changing a dirty diaper. You can use it as often as needed with each diaper change, especially at bedtime so it has time to absorb into the skin. You can easily create your own lotions, sunscreens or diaper rash ointments at home using zinc oxide powder. Try these DIY recipes below which are less likely to trigger irritation and allergies: Zinc Homemade Sunscreen Recipe: Conventional sunscreens can be full of harmful chemicals and toxins that are irritating to your skin. Using a gentle homemade sunscreen will still protect your skin from getting burnt, but also nourish and hydrate dry skin. Additionally, parabens as well as animal-based lanolin are often found in lotions and creams and should be avoided by babies and young children, due to the potential for triggering rashes or allergies. Possible Side Effects of Zinc Oxide Although zinc is considered safe and non-allergenic for majority of people, there is some concern over potential effects of newly developed nanonized zinc particles ZnO-NP in sunscreens. So far studies have found these substances to be safe, but we can expect to see more research emerge in the years to come. If you notice symptoms including swelling, itching, or tingling, stop using zinc containing products and consider vising a doctor if they persist. For people with very sensitive skin to burns, be careful about choosing trustworthy products and testing the effects of homemade creams in small doses. Final Thoughts on Zinc Oxide Zinc oxide is a substance created from zinc and oxygen which is usually found in powder form, but added to many lotions, ointments, sunscreens and rash creams. Zinc oxide has been found to have natural antiseptic and antibacterial abilities. Other benefits include healing epidermal wounds, burns, rashes, skin oiliness, infections and acne. Unlike many chemical sunscreens, zinc oxide protects against UVA and UVB light rays and is often used as a natural, non-toxic sunscreen to prevent burns, signs of photo-aging and irritation. Click here to learn more about the webinar.

DOWNLOAD PDF PHYSICAL PROPERTIES OF ZINC OXIDE

Chapter 6 : Zinc (Zn) - Chemical properties, Health and Environmental effects

*Some Physical Properties of Zinc Oxide-Eugenol Impression Pastes E.W. Skinner, Ph.D. * * Professor of Physics, Northwestern University Dental School, Chicago.*

Chemistry in its element: But zinc is different. Zinc - zinc - zinc - you can almost hear a set of coins falling into an old fashioned bath. It just has to be a hard metal. In use, Zinc is often hidden away, almost secretive. It stops iron rusting, soothes sunburn, keeps dandruff at bay, combines with copper to make a very familiar gold-coloured alloy and keeps us alive, but we hardly notice it. This blue-grey metal, known commercially as spelter, is anything but flashy and attention-grabbing. Even the origins of that evocative name are uncertain. The dictionary tells us that the word zinc comes from the German with a K at the end instead of a C , but how that name came into being is unknown. The earliest reference to zinc was in Represented in the periodic table as Zn, zinc is a transition metal, grouped with cadmium and mercury. With the middling atomic number 30, it has five stable isotopes of atomic weight from the dominant zinc 64 to zinc 70, plus an extra 25 radioisotopes. Although it seems to have been refined in India as early as the twelfth century, the earliest specific claim to have produced the metal was back in , and a process for extracting zinc from its oxide was patented in the UK in by metal trader William Champion. Galvanization is named after Luigi Galvani, the man who made frog legs twitch with electric current, but galvanization has nothing to do with electrical showmanship. The most common form of galvanization is hot dip galvanization, where iron or steel is slid through a bath of liquid zinc at around degrees Celsius, forty degrees above its melting point. The coating prevents the object treated from rusting. Initially the zinc simply stops the air getting to the iron, but later the zinc corrodes in preference to iron in an electro-chemical process, acting as a so-called sacrificial anode. Some galvanization is more literally electrical - car bodies, for example, are electroplated with zinc to apply a thin, even layer. A traditional dry cell has an outer zinc casing acting as the anode confusingly the anode, usually thought of as positive, is the negative end of a battery , while a carbon rod provides the cathode, the positive electrode. In the longer lasting alkaline batteries, the anode is formed from powdered zinc giving more surface area for reaction , while the cathode is made up of the compound manganese dioxide. When molten zinc and copper are mixed together, the result is bold as brass. In fact, it is brass. Everything from door fixings to decorative plaques for horse collars have been made in this flexible alloy. Any orchestra would be much poorer without its brass instruments. Well-polished brass has a pleasant glow - but our most intimate contact with zinc, or to be precise zinc oxide - often comes when dealing with the unwanted glow of sunburn. When I was young and there was little in the way of sun block, sunburned skin would be lavishly coated in soothing pink calamine lotion. Even now, though, when we can avoid the need for calamine, zinc oxide plays its part. That surprise appearance on the breakfast table reflects another important side to zinc. We need it to stay healthy. The zinc ends up in various proteins, particularly in enzymes involved in the development of the body, digestion and fertility. A shortage of zinc in the diet can lead to delayed healing, skin irritation and loss of the sense of taste, and encourages many chronic illnesses. With zinc also appearing in anti-dandruff shampoos in the form of zinc pyrithione and in underarm deodorants as zinc chloride, this is an element that even makes us more attractive to the opposite sex. Zinc is a hidden star. Chris Smith Bristolbased science writer Brian Clegg with the onomatopoeic element, zinc. Katherine Holt The first reports of problems associated with radon gas in domestic buildings was in the United States in , when an employee at a nuclear power plant began setting off the radiation detector alarms on his way into work. The problem was eventually traced to his home, where the level of radon gas in the basement was found to be abnormally high. Chris Smith But where was it coming from and what was the risk to his health. End promo Help text not available for this section currently Video.

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Chapter 7 : Zinc oxide - Wikipedia

Information regarding the physical and chemical properties of elemental zinc and zinc compounds is located in Table Zinc is a lustrous, blue-white metal that burns in air with a bluish-green flame.

Received Sep 8; Accepted Jan 5. We investigated on the optical and electrical properties of the as-sputtered MZO films as dependences on the doping contents in the targets. All the MZO films had shown a preferred orientation in the [] direction. As the quantity and the variety of metal dopants were changed, the crystallinity and the transmittance, as well as optical band gap were changed. The electrical resistivity was also changed with changing metal doping amounts and kinds of dopants. An epitaxial Li-doped ZnO film has a high resistivity and very smooth surface; it will have the most optimum conditions which can be used for the piezoelectric devices. ZnO has typical n-type semiconductor properties because of a nonstoichiometric defected structure and electrical properties according to chemical composition changes. ZnO has piezoelectric properties, wide band gap 3. Second, group I element Li, Na, and K -doped ZnO thin films have a high resistivity due to a dopant that accepts a carrier [4]. In the case of the group II-VI oxide semiconductor, oxygen defect, chemical composition, and impurities have significant influences on physical properties such as electrical resistivity, piezoelectricity, and structure. The change of property in ZnO had been reported. It was found that Li atoms in Li-doped ZnO films were involved in the substitution for Zn atoms; they acted as acceptors that compensate the excess Zn atoms [5]. We mainly studied on the effects of deposition conditions on the structural and electrical properties of ZnO films that will be applied as piezoelectric devices. Experimental detail Two kinds sputtering targets were prepared by mixing with zinc oxide and lithium chloride powders, and zinc oxide and silver nitrate powders where the ratio of dopants was increased from 0 to 10 wt. MZO films were deposited on glass substrates at room temperature with a radio frequency [RF] power of W at a target-to-substrate distance of 70 mm. The thickness of the MZO films was up to nm on the glass substrates for optical measurements. The crystal structure, microstructure, and the thickness were observed using X-ray diffraction [XRD] and a scanning electron microscope. Atomic force microscopy was used to examine the surface roughness. X-ray photoelectron spectroscopy and energy dispersive X-ray spectroscopy were also utilized to analyze the chemical ratio of the MZO films. The electrical resistivity was measured by a four-point probe method. The reason for the result is that the lattice parameter of the SZO films was increased in the c-axis with the increasing Ag dopant such that the large Ag ions pm were substituted for the Zn ions 72 pm in the SZO crystal. This means that the crystallinity decreased considerably with increasing Ag dopant in the SZO films while a large silver ion substituted into a zinc ion site. The SZO films with poor crystallinity are hard to apply in piezoelectric devices. As the amount of the Li dopant increased, the intensity and angle of the diffraction peak are also decreased and increased, respectively. These results indicate that the lattice constants of the ZnO crystals are gradually decreased due to Li substitution. In detail, with the increasing amount of Li dopant, an asymmetric diffraction peak that is attributed to the LZO thin film formation appeared, and the diffraction angle is also shifted toward a high degree from This suggests that the lattice constants in the c-axis of the ZnO crystal or films decrease with the substitution of Li ion into Zn sites. Many researchers reported that most of the Zn sites were substituted by a doping ion of a larger size than the Zn ion. On the contrary, it was reported that dopants can be substituted or inserted because the doping ion was smaller than the Zn ion [6 , 7]. This is in good agreement with our data.

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Chapter 8 : Zinc Oxide Benefits: A Safer Sunscreen + So Much More - Dr. Axe

between zinc oxide and eugenol have revealed the nature of the setting reaction, and more recently, the clinical and physical properties of commercially available impres- sion pastes have been investigated.'1

Zinc Zinc is a lustrous bluish-white metal. It is found in group IIb of the periodic table. It is a fairly reactive metal that will combine with oxygen and other non-metals, and will react with dilute acids to release hydrogen. It is used for the negative plates in some electric batteries and for roofing and gutters in building construction. Zinc is the primary metal used in making American pennies, is used in die casting in the automobile industry. Zinc oxide is used as a white pigment in watercolours or paints, and as an activator in the rubber industry. As a pigment zinc is used in plastics, cosmetics, photocopier paper, wallpaper, printing inks etc, while in rubber production its role is to act as a catalyst during manufacture and as a heat disperser in the final product. Zinc metal is included in most single tablet, it is believed to possess anti-oxidant properties, which protect against premature aging of the skin and muscles of the body. Zinc in the environment Zinc is a very common substance that occurs naturally. Many foodstuffs contain certain concentrations of zinc. Drinking water also contains certain amounts of zinc, which may be higher when it is stored in metal tanks. Industrial sources or toxic waste sites may cause the zinc amounts in drinking water to reach levels that can cause health problems. Zinc occurs naturally in air, water and soil, but zinc concentrations are rising unnaturally, due to addition of zinc through human activities. Most zinc is added during industrial activities, such as mining, coal and waste combustion and steel processing. Some soils are heavily contaminated with zinc, and these are to be found in areas where zinc has to be mined or refined, or were sewage sludge from industrial areas has been used as fertilizer. The dominant ore is zinc blende, also known as sphalerite. Other important zinc ores are wurzite, smithsonite and hemimorphite. World production exceeds 7 million tonnes a year and commercially exploitable reserves exceed million tonnes. Health effects of zinc Zinc is a trace element that is essential for human health. When people absorb too little zinc they can experience a loss of appetite, decreased sense of taste and smell, slow wound healing and skin sores. Zinc-shortages can even cause birth defects. Although humans can handle proportionally large concentrations of zinc, too much zinc can still cause eminent health problems, such as stomach cramps, skin irritations, vomiting, nausea and anaemia. Very high levels of zinc can damage the pancreas and disturb the protein metabolism, and cause arteriosclerosis. Extensive exposure to zinc chloride can cause respiratory disorders. In the work place environment zinc contagion can lead to a flu-like condition known as metal fever. This condition will pass after two days and is caused by over sensitivity. Zinc can be a danger to unborn and newborn children. When their mothers have absorbed large concentrations of zinc the children may be exposed to it through blood or milk of their mothers. This basically means that more and more zinc ends up in the environment. Water is polluted with zinc, due to the presence of large quantities of zinc in the wastewater of industrial plants. This wastewater is not purified satisfactory. One of the consequences is that rivers are depositing zinc-polluted sludge on their banks. Zinc may also increase the acidity of waters. Some fish can accumulate zinc in their bodies, when they live in zinc-contaminated waterways. When zinc enters the bodies of these fish it is able to bio magnify up the food chain. Large quantities of zinc can be found in soils. When the soils of farmland are polluted with zinc, animals will absorb concentrations that are damaging to their health. Water-soluble zinc that is located in soils can contaminate groundwater. Zinc cannot only be a threat to cattle, but also to plant species. Plants often have a zinc uptake that their systems cannot handle, due to the accumulation of zinc in soils. On zinc-rich soils only a limited number of plants has a chance of survival. That is why there is not much plant diversity near zinc-disposing factories. Due to the effects upon plants zinc is a serious threat to the productions of farmlands. Despite of this zinc-containing manures are still applied. Finally, zinc can interrupt the activity in soils, as it negatively influences the activity of microrganisms and earthworms. The breakdown of organic matter may seriously slow down because of this.

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Chapter 9 : Zinc, Chemical Element - reaction, uses, elements, examples, metal, gas, number, name

The physical properties of zinc changes some depending on the temperature it is exposed to. Normally hard and brittle, it becomes malleable between and degrees Fahrenheit. Once the metal hits degrees it becomes brittle once more.

A constituent of numerous enzymes, zinc plays a structural role in proteins and regulates gene expression. Zinc deficiency in humans was first reported in the s in Egypt and Iran, where children and adolescent boys with stunted growth and undeveloped genitalia responded to treatmentâ€¦ Occurrence, uses, and properties A little more abundant than copper , zinc makes up an average of 65 grams 2. Native zinc has been reported from Australia , New Zealand , and the United States , and the leading early 21st-century producers of zinc are China , Australia and Peru. Zinc is an essential trace element in the human body , where it is found in high concentration in the red blood cells as an essential part of the enzyme carbonic anhydrase , which promotes many reactions relating to carbon dioxide metabolism. The zinc present in the pancreas may aid in the storage of insulin. Zinc is a component of some enzymes that digest protein in the gastrointestinal tract. Zinc deficiency in nut-bearing and fruit trees causes such diseases as pecan rosette, little leaf, and mottle leaf. Metallic zinc is produced by roasting the sulfide ores and then either leaching the oxidized product in sulfuric acid or smelting it in a blast furnace. Zinc is won from the leach solution by electrolysis or is condensed from the blast furnace gas and then distilled of impurities. For specific information on the mining, recovery, and refining of zinc, see zinc processing. The major uses of zinc metal are in galvanizing iron and steel against corrosion and in making brasses and alloys for die-casting. Zinc itself forms an impervious coating of its oxide on exposure to the atmosphere, and hence the metal is more resistant to ordinary atmospheres than iron and corrodes at a much lower rate. In addition, because zinc tends to oxidize in preference to iron, some protection is afforded the steel surface even if some of it is exposed through cracks. The zinc coating is formed either by hot-dip galvanizing or electrogalvanizing. This may be a batch process known as general galvanizing or a continuous coating of coils of steel strip. Layers of iron-zinc alloy are formed on the surface and are topped with an outer layer of zinc. Objects so treated range from small nuts and bolts to steel window frames and large girders used in construction. An ordinary grade of zinc containing up to 1. In electrogalvanizing , zinc is deposited on a steel strop in as many as 20 consecutive electrolytic coating cells. There are several successful cell designs; the simple vertical cell is discussed here to explain the principle. The strip, connected to the negative side of a direct current through large-diameter conductor rolls located above and between two cells, is dipped into a tank of electrolyte by a submerged sink roll. Partially submerged anodes , opposing the strip, are connected to the positive side of the electric current by heavy bus bars. The bath is supplied with zinc cations either by zinc anodes, which are continuously dissolved by the direct current, or by zinc compounds continuously added to the electrolyte. In the latter case the anodes are made of insoluble materials, such as titanium coated with iridium oxide. The electrolyte is an acidic solution of zinc sulfide or zinc chloride with other bath additions to improve the quality of the coating and the current efficiency. Coating thickness is easier to control than in the hot-dip process because of the good relationship between electrical current and deposited zinc. The negative electrode outside can in one common type of electric dry cell is composed of zinc. Another important series of alloys are those formed by the addition of 4 to 5 percent aluminum to zinc; these have a relatively low melting point but possess good mechanical properties and can be cast under pressure in steel dies. Considerable quantities of zinc in the rolled form are used for roofing, particularly in Europe; small additions of copper and titanium improve creep resistance â€”i. Freshly cast zinc has a bluish silver surface but slowly oxidizes in air to form a grayish protective oxide film. Highly pure zinc Zinc crystallizes in the hexagonal close-packed structure. This so-called sacrificial protection, coupled with the much greater corrosion resistance of zinc under atmospheric conditions, is the basis for galvanizing. Natural zinc is a mixture of five stable isotopes: History Metallic zinc appeared much later in history than the other common metals. Copper , lead , tin , and iron can be obtained as the molten metals by heating their oxide ores with charcoal carbon , a process called reduction, in shaft furnaces, which were developed quite early in history. Thus, the furnaces developed to smelt the other metals could not produce zinc. Small quantities of metallic zinc can sometimes be found in the flues of lead blast furnaces. The Romans as early as bce produced considerable quantities of brass , an alloy of zinc and copper, by heating in crucibles a mixture of zinc oxide and charcoal covered with lumps of metallic copper. The zinc oxide was reduced in the lower part of the crucible. Zinc vapour was formed and dissolved in the copper to form brass. At the end of the process the temperature was raised to melt the brass for casting into ingots. The realization that to make zinc it was necessary to produce the metal as a vapour and then condense it seems first to have been reached in India in the 13th or 14th century. The metallurgists of China had achieved large-scale production of zinc by the 16th century. In the West this principle was first applied in England in under the leadership of William Champion. At the end of the 18th century in Belgium and Poland improvements were made in the furnace, and the process remained unchanged until an electrolytic process was developed in At the end of the s a radical advance was made in the United States by developing a continuous retort process, and during the s an electrothermic process was designed for producing zinc continuously. A development of the s was the zinc-lead blast furnace, in which rapid quenching of the gases is a key principle. Zinc production processes are treated in detail in zinc processing. Zinc oxide , ZnO, is one of the most important zinc compounds. It can be prepared in a state of high purity and in a variety of crystal shapes and sizes by burning zinc vapour in air. Because of its high heat conductivity and capacity, zinc oxide is frequently incorporated into rubber as a heat dissipater. In the crystal of zinc oxide, the lattice i. Defects can be created in the lattice by specific treatments such as the introduction of foreign atoms or of zinc atoms in the vacancies of the lattice. Such treatment of zinc oxide crystals produces various electrical, photoelectrical, and catalytic properties. As a result, zinc oxide is used as a semiconductor in the production of phosphors for television tubes and fluorescent lamps. Its effects on the reactivity of many compounds make it useful as a catalyst in such operations as the manufacture of synthetic rubber and methanol. It is also used in paints, cosmetics , plastics , pharmaceuticals , and printing inks. Because under the influence of light the electrical conductivity of zinc oxide can be increased many times, it is employed in certain photocopying processes. Zinc sulfate , $ZnSO_4$, is an intermediate compound in the production of zinc from its ores by the electrolytic process. It is used as a weed killer, in the manufacture of viscose rayon , and in dyeing, in which it functions as a mordant. Zinc chloride , $ZnCl_2$, can be prepared by a direct reaction or by evaporating the aqueous solution formed in various reactions. It is strongly deliquescent water-absorbing and is utilized as a drying agent and as a flux. In aqueous solution it is used as a wood preservative. Zinc sulfide , ZnS, occurs in nature as the mineral sphalerite and may be prepared by treating solutions of zinc salts with hydrogen sulfide. It was long used as a white pigment but has been gradually replaced by titanium dioxide. Zinc sulfide has luminescent properties when activated by the addition of small quantities of copper, manganese , silver , or arsenic and so has been used in X-ray screens, in luminous dials for clocks and watches , and in fluorescent lights. Learn More in these related Britannica articles: