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Vital Element of Modern Technology: Gold

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Abstract: *Gold is one of the few elements that can affect politics and economics. Wars have been fought over access to gold. Cities and towns have sprung up and died out as gold was discovered and then mined out. Many nations still count their wealth according to the amount of gold they keep in storage. Gold is the perfect commodity. Resistant to rust and corrosion, gold is the world's most reliable and durable electrical conductor, essential for computer electronics and satellite communications technologies. No other substance of the same rarity holds a more visible and prominent place in our society.*

1. Introduction

The element gold has many personalities, of which the image of a noble but soft, yellow metal would first across one's mind. The recently discovered nanoparticles and nanowires containing gold are a natural extension of this aspect, as are the uses of gold in electronics [1] and decoration. Thought to be noble, gold actually has a rich chemistry. Fascinating in its complexity for academic chemists, this chemistry has potential applications in materials science [2-3], medicine [4-5] and, recently, in both heterogeneous [6] and homogeneous catalysis [7]. It is also promising in the field of optics due to optical properties of certain gold compounds [8] and also show the possibility of forming new nanostructures [9-10]. The unique properties of gold are strongly influenced by relativistic effects [11].

The past few decades have seen remarkable advances in gold and organogold chemistry. The advances have been made possible largely as a result of the use of physical techniques for the determination of structures, and in particular the use of single crystal X-ray diffraction, multinuclear magnetic resonance and gold-197 Mossbauer spectroscopy. The first compound of gold which was prepared and characterized as an industrial product is potassium gold(I) cyanide, which is the form in which gold is used in most gold plating baths. The chemistry of gold was merely regarded as an art to recover and convert gold metal into all possible forms of ornamental, monetary, anticorrosive or electrical usage. It is therefore no surprise that the chemistry of gold, which is so clearly dominated by the metallic state, remained undeveloped for so long. The associated development of an old handicraft, with all its secrets, into a field of research based on technology is a good example of how gold chemistry has finally matured into an advanced branch of science with a significant bearing on applications in many fields. It does not react with the human body, therefore, gold is finding new uses as a diagnostic tool in medicine (e.g., pregnancy testing, salmonella detection, HIV testing), in new treatments for cancer, and new methods of fighting microbial infection [12].

1.1. Gold in Electronics Industry

The most important industrial use of gold is in the manufacture of electronics. Solid state electronic devices use very low voltages and currents which are easily interrupted by corrosion or tarnish at the contact points. Gold is the highly efficient conductor that can carry these tiny currents and remain free of corrosion. Electronic components made with gold are highly reliable. Gold is used in connectors, switch and relay contacts, soldered joints, connecting wires and connection strips. A small amount of gold is used in almost every sophisticated electronic device. This includes cell phones, calculators, personal digital assistants, global positioning system (GPS) units, and other small electronic devices. Most large electronic appliances such as television sets also contain gold. One challenge with the use of gold in very small quantities in very small devices is loss of the metal from society. Nearly one billion cell phones are produced each year, and most of them contain about fifty cents worth of gold. Their average lifetime is under two years, and very few are currently recycled. Although the amount of gold is small in each device, their enormous numbers translate into a lot of unrecycled gold [13].

1.2. Gold in computers

Gold is used in many places in the standard desktop or laptop computer. The rapid and accurate transmission of digital information through the computer and from one component to another requires an efficient and reliable conductor. Gold meets these requirements better than any other metal. The importance of high quality and reliable

performance justifies the high cost. Edge connectors used to mount microprocessor and memory chips onto the motherboard and the plug-and-socket connectors used to attach cables all contain gold. The gold in these components is generally electroplated onto other metals and alloyed with small amounts of nickel or cobalt to increase durability [14]

1.3. Gold in Aeronautics technology

Gold is a vital component of every NASA spacecraft. Gold is used in circuitry because it is a dependable conductor and connector. In addition, many parts of every space vehicle are fitted with gold-coated polyester film. This film reflects infrared radiation and helps stabilize the temperature of the spacecraft. Without this coating, dark colored parts of the spacecraft would absorb significant amounts of heat. Gold is also used as a lubricant between mechanical parts. In the vacuum of space, organic lubricants would volatilize and they would be broken down by the intense radiation beyond earth's atmosphere. Gold has very low shear strength, and a thin film of gold between critical moving parts serves as a lubricant. The gold molecules slip past one another under the forces of friction and that provides a lubricant action [15].

1.4. Gold in medical technology

Gold is used as a drug to treat a small number of medical conditions. Injections of weak solutions of sodium aurothiomalate or aurothioglucose are sometimes used to treat rheumatoid arthritis [16]. Particles of a radioactive gold isotope are implanted in tissues to serve as a radiation source in the treatment of certain cancers [17]. Small amounts of gold are used to remedy a condition known as lagophthalmos, which is an inability of a person to close their eyes completely [18]. This condition is treated by implanting small amounts of gold in the upper eyelid. The implanted gold weights the eyelid, and the force of gravity helps the eyelid close fully. Radioactive gold is used in diagnosis. It is injected in a colloidal solution that can be tracked as a beta emitter as it passes through the body [19]. Many surgical instruments, electronic equipment, and life-support devices are made using small amounts of gold. Gold is nonreactive in the instruments and is highly reliable in the electronic equipment and life-support devices [20]. Gold alloys are used for fillings, crowns, bridges, and orthodontic appliances. Gold is used in dentistry because it is chemically inert, nonallergenic, and easy for the dentist to work [21].

2. Conclusion

Our knowledge of gold and its uses and potential uses has expanded steadily, in step with that on other metals. As a result, its industrial applications are no longer confined to traditional areas such as jewellery fabrication, decoration and dentistry. The special attributes of gold have created lively demand for it in a large number of scientific and high-technology applications, and especially in microelectronics. The need to use gold efficiently to avoid the use of cheaper metals in its place have provided the incentives for an ever increasing volume of research on gold. This state of affairs should continue, with the uses of gold becoming more diverse in a variety of high technology applications in the future.

3. References

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