Middle-East Journal of Scientific Research 8 (4): 795-798, 2011
ISSN 1990-9233

Analytical Global Demand in the Use of Advanced Ceramics with Silicon Carbide Growth

A.S. Mirkamali

Department of Science and Engineering, Behshahr branch,
Islamic Azad University, Behshahr, Iran

Abstract: Market growth of advanced silicon carbide ceramics up to $ 12 billion to the Year 2010 is anticipated. America has predicted that demand for advanced ceramics since 2005, seven percent per year increase and more than $ 12 billion reached in 2010. In 2003, the industry began a growth in 2004 and 2005 AD, gained strength and by 2010, the growth will continue. Demand for ceramic advanced market systems industry since 2005 AD, every year 3 / 5 percent increase for which this trend continued until 2010 AD. The major growth industries of the market to improve circulation to the market following the drop in the early 2000. Silicon carbide ceramics with growth highest growth rate with respect to their applications in medical products, electronic components market environment and will show. Continuing expansion of electrical goods can use other markets than titanium and ceramic will provide.

Key words: Silicon · Carbide · Advanced · Demand growth · Economic

INTRODUCTION

Ceramic Products: These Products Can Be Divided into Two Main Groups

Traditional Ceramics: Ingredient industries, i.e., silicates clay products, cement and silicate glasses and the Chinese are Ceramic products, glass industry are the largest. Other sections in order of priority are Domestic cement products (such as hydraulic cements used in the construction industry to reach), white instruments, (White ware included pottery, Chinese porcelain, and compounds like), Chinese glazes, structural clay products (bricks and tiles) refractory, industrial abrasives manufacturer (Alumina and silicon carbide abrasive) [1-2].

New Ceramics: To meet specific needs such as higher heat resistance, mechanical properties and better electrical properties and chemical resistance; and especially there is and will have greater need. These types of ceramics group are:

- Advanced Ceramics with the growth of silicon carbide can be used in electronic components, semiconductors and capacitors, etc.
- Pure oxide ceramics with uniform building: As with refractory electrical components are used (in which parts are explained more lately) like alumina (Al_2O_3), zirconium (ZrO_2), ThO_2, BeO, and MgO are used more.
- Ceramic Electro Optics (E-light): Like $LiNbO_3$ and the Titan that they provide an environment by which electrical signals are converted to light.
- Magnetic Ceramics: The material basis of magnetic memory units constitute the large computers.
- Nitride ceramics: including aluminum nitride, silicon nitride and boron nitride refractory and strength very well that the temperatures are high.
- Ceramic carbides: as the abrasive used.
- Ceramic borides: of strength and oxidation resistance at high temperatures are important.
- Ceramics Ferro Electric: with very high dielectric constant and electronic components as is used in capacitors [3-4].

Classification of Modern Ceramics

Special Products and Technical Ceramics: These products are mainly from synthetic materials used and are pure. Features original compositions and material terms of the products they use for different

Corresponding Author: A.S. Mirkamali, Department of Science and Engineering, Behshahr branch, Islamic Azad University, Behshahr, Iran.

cases. These complex products, mainly in connection with the development and evolution of other industries are discussed. Electronics industry, space research, nuclear energy, electric power, aviation industries [5].

Refractory Refractions: refractory products that are generally bending at temperatures higher than 580°C are achieved. Consumption of this product is in building furnaces. If the bricks, mortar and coatings of various types and specific products, industries of all stages of the production process require high temperatures they used are in melting industries such as metal, glass melting, cement, chemical industries and nuclear industries use these products.

Rugged Products Heavy Clay
Fine Products Pottery: that includes household utensils, tiles, sanitary ceramics, and electrical insulators.

Oxide Ceramics: ceramic oxide that the following types are most used in microelectronics industries has. Reason to tolerate the high voltage and leakage current depends on what it is low in BeO, Titanium, Alumina, and Zirconium.

Ceramics Classified: This type of ceramics classified according to their combination are some of the most commonly used and are the following:

Nitride: This class of materials with high heat tolerance is due to different elements of their Fermi surfaces are capable according to the series junction or middle layer is formed as the electron carrier is trapped. Such as BN, TiN, Si_3N and GaN.

Carbide: Although the two methods and reactive powder are produced. However, apart from the high heat temperature, resistance, and tension is high as many layers of protective coating material is used such as SiC and TiC [4-6].

Structure of Silicon Carbide Ceramics: Nanotechnology is also in terms of its scientific and technical branches of industrial applications and can be classified. Some branches of science and technology include nano powder, nanoceramic, NanoElectric, nanomedicine and Nanobiotechnology [7].

Nano silicon carbide ceramics with the growth of tiny particles that are solid and crushing large pieces, or deposition of solid particles suspended in solution to come. Therefore, the growth of silicon carbide nanoceramics can be considered as a set of particle size less than 100 nanometers. Generally, nanosilicon carbide ceramics with the growth of the nanoscale materials as well as the other two methods can be bottom-up or top-down to produce. In top-down approach to segment large selection of sizes and made it so we come to the sizes. In bottom-up approach, the atom seed grain to put together a nanometer structures arises (the way its growing season ends) nanosilicon carbide ceramics with the growth in the following three conditions:

The Structure Formed Ceramic Particles in the Nanometer Range: If the constituent particles of a ceramic structure are to be one of the regular geometric shapes to consider, the average size of its sides is between 1 to 100 nanometers. The most important geometric shapes are butter and cubes. If the structure of the ceramic particles Let butter, butter must be less than 100 nanometers in diameter and if the structure is cubic, the average should be within a cube sides to be 100 nm. From a mathematical point of view, for example, salt crystals are cube shaped structure. If more particles formed ceramic, dimensions between 1 to 100 nanometers have the ceramics, and then nanoceramics can be considered [8].

Ceramic Constituent Grains, Have Nanometer Dimensions: In case the particle size formed ceramics is higher than one hundred nanometers, it is enough grain size for nanometer to have become a Nanoceramic. An example with which to understand this issue is that the atoms are regularly within cells and that they "seed" call, having been together. Solid crystalline materials are composed of cells that planned to sow their seeds. Within each grain, the atoms are in a certain direction, are arranged in parallel rows, and between two adjacent grains, are the difference between atoms in the same direction. In a grain, the atoms in rows parallel with the angle of 45 degrees from horizontal are arranged. Two atoms in the grain with the grain angle of 90 degrees and 120 degrees angle of three atoms with the horizontal line are arranged. When these seeds are placed together, a particle is formed. The gaps between grains are "grain boundaries." The local grain boundary atoms to be arranged are changed. The seeds can assume structures, like bricks of a wall and in this case, the boundary between grains is mortar between bricks. If the diameter of the grain is between 1 to 100 nm, the formation of nanoceramic particles and adults. The diameter of grains

is a bit less (but with constant volume), the number of its constituent grains will be higher (it is clear that whatever constituent bricks in a wall are smaller, the number of bricks will be higher). However many more grains, such as nodes of a carpet, the fabric is stronger and therefore complex mix strength of the product will be higher. If a significant percentage of grains' constituent particles are nanometer, ceramics, nanoceramics can be considered [9].

Mode III: Nanoceramic Particles and Ceramic Particles Are Combined Ordinary: In this case, the ceramic "composite nanoceramics" call. The composite composition was taken from the English word, means combining two or more things. The best example for the composite is thatch. Thatch straw in fields scattered flowers in the field. Nanocomposite ceramics in the larger particles in the field of nanometer particles were dispersed. Due to their combined properties of these two materials is different. The composite field of a material is usually soft and hard material additives are chosen. In this case, when the matter is force, force field or powder added to the field will be able to move against the force be imported more resistance.

Economical Use of Advanced Ceramics with Silicon Carbide Growth: Metal coatings technology with a layer of silicon carbide ceramics for growth in many cases already seen that metals and surfaces that are functioning much friction cause of Advanced ceramics with silicon carbide growth are covered, but this approach cannot be considered with the same advanced technology. If you want high levels of friction ceramic coating layer then three major problems exist:

- It is very expensive ceramic layer.
- It should be before the assembly parts to be done in specific situations that will increase production costs or the device for this purpose must be stopped parts of it opened and after ceramic coating operations to assemble it again. Maybe this action on motor cars is easy, but not for the giant industrial machines. Opening and closing a giant machine that for example in car production line is active for at least three or four days it takes is equal to appease or shut down a line presents thousands or even millions of dollars in financial losses.
- Ceramic layer is a bit fragile and stress imposed on parts of this layer is created.

Advanced Electronic Ceramics Using Silicon Carbide Growth: Using advanced ceramic silicon carbide growth largely depends on health, electrical equipment and electronic components which met 52 percent of total demand in 2005. Electronic component market, mobile production, the audit of portable devices, game systems and other personal electronic devices, the market demand semiconductors, capacitors and other electronic components ceramic spur [9-11].

Largest market for advanced ceramics with silicon carbide growth in the insulation of electrical equipment and permanent magnets constitute the entire market and met 38% of the total demand in 2005. Other equipment including advanced ceramic electric burners, heating elements, thermal shield components, connectors and joints, are examples. Use of all the advanced ceramic silicon carbide growth in this market takes place when the electrical equipment on an assembly machine and transport equipment are used (Table 1).

Growing Demand for Advanced Ceramics with Silicon Carbide Growth: Demand for advanced ceramics in the industrial machinery market every year since 2005 AD, 3.5% has increased until 2010 AD, and this trend will continue. The major growth industries of the market to improve circulation to the market following the drop in early 2000 will be. As applications of machine tools and other industrial machines macroeconomic environment benefits are stronger interest, the need for increased capacity, optimal use of waste and improve efficiency capacities existing systems, an opportunity for manufacturers of ceramic components will provide coverage. Shear means that the product is most used and, more demand for economic recovery tools needed to cut and form metals provides (the mono ceramics, non-reinforced ceramic, which directly shaped in the form of final come on) (Table 2).

Table 1: Table of demand for advanced ceramics with silicon carbide growth in the market (million dollars)

	Percent annual growth				
	2010-2005	2005-2000	2010	2005	2000
Total Demand	7	-1	12100	8625	9050
Electronic Parts	7.9	-5.5	4130	2820	3750
Electrical equipment	7.1	1	2370	1680	1670
Industrial machinery	5.3	0.6	1500	1160	1124
Transport equipment	7.1	1.4	1600	1135	1060
Other markets	6.4	4.8	2500	1830	1446

Table 2: Growth in demand for advanced ceramic silicon carbide (million dollars)

	Percent annual growth				
	2010-2005	2005-2000	2010	2005	2000
Total Demand	0.7	-0.1	12100	8625	9050
Ceramics	1.7	-2.1	10600	7530	7980
Ceramic coating	4.6	-8.0	1050	770	740
Ceramic matrix compound	7.6	-3.0	450	325	330

Silicon carbide ceramics with highest growth rate with respect to the application of medical products, electronic components market environment and will show continuing expansion of electrical goods efficiency that Titanium and other ceramics will provide. Continuous tendency to decrease particulate matter, nitrogen oxides and sulfur oxides in the atmosphere, causing the further use of Titanium ceramic and other materials. Technical advances in the medical field opportunities for the use of ceramics such as the following will provide. Other advanced ceramics including alumina, because environmental issues, competition and dependence on other ceramic goods which they market is less growth, such as cutting tools, less than usual are used [11-15].

CONCLUSION

Although the advanced ceramic industry in some areas is complete and well established, but still a lot of technical knowledge remains. Application of new ceramic increases the potential that their use can be, ballistic armored coating, composite brakes, ceramic car, filter the fine particles for diesel engines, wide range of products and joint replacement sensors pointed. Therefore, with income levels as they are, investment in this sector by the government seems quite logical.

REFERENCES

1. Briggs, G., 1993. Surface analysis by Auger and X- ray photoelectron spectroscopy, pp: 4-7.
2. Green, M.L., D. Brasen, L. Feldman, E. Garfunkel, E.P. Gusev, T.Gustafsson, W.N. Lennard, H.C. Lu and T. Sorsch, 1998. Thermal Routes to Ultrathin Oxynitrides, Kluwer Academic Publishers, Dordrecht, Netherlands, pp: 181.
3. Cengiz, B., 2011. Microstructural characterisation of -SiC powders synthesised by carbothermally reduction of Turkish diatomite. Sci. Res. Essays, 6(3): 542-551.
4. Akhtar, F., P.O. Vasilliev and L. Berkström, 2009. Hierarchically porous ceramics from diatomite powders by pulsed current processing. J. Am. Ceram. Soc., 92(2): 338-343.
5. Bagci, C. and H. Arık, 2010. Investigation of direct pressureless sinterability of Si3N4 produced from brown sepiolite and its characterization Sci. Res. Essays., 5(3): 309-321.
6. Devecerski, A., M. Posarac, A. Egelja, A. Radosavljevic-Mihajlovic, S. Boskovic, M. Logar and B.J. Matovic, 2008. Fabrication of SiC by carbothermal-reduction reactions of mountain leather asbestos.Alloys Comp., 464: 270-276.
7. Dhage, S., H.G. Lee, M.S. Hassan, M.S. Akhtar, C.Y. Kim, J.M. Shon, K.J. Kim, H.S. Shin and O.B. Yang, 2009. Fabrication of SiC nanowhiskers by carbothermic reduction of silica with activated carbon. Mater. Lett., 63: 174-176.
8. Saponjic, A., B. Babic, A.Devecerski and B. Matovic, 2009. Preparation of Nanosized Non-Oxide Powders Using Diatomaceous Earth. Sci. Sinter., 41: 151-159.
9. Uygur, I., 2004. Tensile behaviour of P/M processed (Al-Cu-Mg-Mn) / SiCp composites. Iranian J. Sci. Technol., B28(B2): 239-248.
10. Yang, Y., Z.M. Lin and J.T. Li, 2009. Synthesis of SiC by silicon and carbon combustion in air. J. Eur. Ceram. Soc., 29: 175-180.
11. Zhu, S., S. Ding, H. Xi and R. Wang, 2005. Low-temperature fabrication of porous SiC ceramics by preceramic polymer reaction bonding. Mater. Lett., 59: 595-597.
12. Zati Rostami, A. and A. Bahari, 2009. Investigation of Si/SiC Ceramic Composite Properties. World Appl. Sci. J., 6(8): 1103-1106.
13. Saedodin, S., M. Torabi, J. Moghimi Kandelousi and N. Maghsodloo, 2010. Application of Net Radiation Transfer Method for Optimization and Calculation of Reduction Heat Transfer, Using Spherical Radiation Shields. World Appl. Sci. J., 11(4): 457-461.
14. Esfandiari, A., 2008. PPy Covered Cellulosic and Protein Fibres Using Novel Covering Methods to Improve the Electrical Property. World Appl. Sci. J., 3(3): 470-475.
15. Gbaruko, B.C. and J.C. Igwe, 2007. Tungsten: Occurrence, Chemistry, Environmental and Health Exposure Issues. Global J. Environ. Res., 1(1): 27-32.