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Editor-in-Chief Prof. Leszek A. Dobrzański

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by the World Academy of Materials
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It was said...

JACQUES ROGGE

President
of the International Olympic Committee

"I am delighted to be back in Athens, the spiritual home of the Olympic Movement. This city was transformed by the 2004 Olympic Games. Everywhere you look, you see the legacy of improvements to infrastructure, transport, roads and – best of all – there are new sports facilities and a new confidence in the Greek people. (…) In a few short weeks many of you will join me in Beijing for the Games of the 29th Olympiad (…), one of the most eagerly anticipated Games in Olympic history. The world will be watching to see if these Games become a transforming event for the most populous nation on earth, a country with a rich tradition, a glorious culture and a bright future. I am pleased to report that preparations for Beijing 2008 are going well. (…) Because of technology, human connections are no longer constrained by time, distance or national boundaries. Human connections are what the Olympic Movement is all about. The Olympic Games bring people around the globe together – athletes, spectators, host citizens – to celebrate their common humanity in an atmosphere of mutual respect, fair play and friendship. (…) The Beijing 2008 Olympic Games will be an historic event, even by Olympic standards, and I am eager for them to start. For 16 days in August, the eyes of the world will be on China. Over 30,000 media, some 2.4 million spectators and 4 billion television viewers will experience the thrill of world-class athletic competition, with all the drama, jubilation and heartbreak that it entails. Inside the Bird's Nest, the Water Cube and other Olympic venues, the focus will rightfully be on the athletes, many of whom have spent years training to get to Beijing. But the journalists, spectators and television viewers will also learn about China – about its culture, about its history and about the challenges it faces as a nation in transition. We have seen this happening already. This is one of the transformative powers of sport and the Olympic Games."

From the speech on 3rd June 2008 during the Opening Ceremony of the Sport Accord Convention at the Athens Concert Hall in Athens, Greece.

Editorial

Archives of Materials Science and Manufacturing deals with its content-related interests of all groups of engineering materials and technologies of its production and manufacturing and also the characterisation of its properties depending on its chemical composition and the kind of material and applied technological process and structural phenomenon and phase changes which are caused by those processes. A paradigm of materials engineering joins the selection of material on a given product in order to ensure its maintenance functions by desired physical and chemical properties because of the assurance of required structure and a shape in suitably chosen technological processes. One of the basic group of engineering materials among metals, polymers, composites is ceramics.

A group of non-organic materials having ionic and covalent interatomic bonds created usually in high-temperature processes is called ceramics. Glass and glass ceramics is also included in that group. A man mastered the process of ceramics firing before he familiarised with metals and their alloys. There are proves for that in many parts of the world, mainly in the region of Mesopotamia and Anatolia. In the Bible in the 1st Book of Moses the following sentence can be found "Let us go to prepare bricks and fire them in fire". The unusual proof of mastering this technique in Asia is a Terracotta Army guarding the grave of the First Emperor of China – Qin Shi Huangdi dated from 3rd century B.C., situated near present Xi'an in the north Chinese province Shaanxi.

Ceramic materials are composed of at least two elements, and often their bigger number and their crystalline structure is more complex than the one of metals. Between atoms in those materials there are bonds of either purely ionic or wholly covalent ones, and in many ceramic materials there is a combination of those two kinds of bonds. In ceramic materials in which ionic bonds predominate, there is the counterbalance between positively charged cations – ions of metals giving back their valence electrons and negatively charged – ions of non-metals. Structure of some ceramic materials is characterised by the fact that the number of cations and anions marked adequately as A and X is identical. Suitable phases marked as A and X, can be characterised by a few types of crystallographic structures. In a case when charges of cations and anions are not the same, phases of A_mX_p type, where m or/and $p \neq 1$, eg. AX_2 or A_2X_3 can appear. It is possible that also more than one type of cations appear. In a case when two types of cations marked respectively by A and B appear phases of $A_mB_nX_p$ types are created.

At present two basic groups of engineering ceramic materials can be mentioned: engineering ceramics and porous ceramics. Since the 1930s ceramic fibres, which production developed after 1965, mainly because of requirements of aerospace and airspace industry, mainly for the application of composite materials, have been known.

Engineering ceramics is applied in automotive and aerospace industry, in the manufacturing processes, electronics and in the high-temperature applications and medicine. Ceramic materials show also electrical and magnetic properties. The application of engineering ceramics includes wear resistant materials, bearings, car elements, energy instrumentation, endoprostheses and various elements in aerospace, air and military industry and very often cutting tools.

Porous ceramics found the application in civil engineering and refractory, clay, porcelain, enamel and abrasive products. This ceramics is also determined as traditional, classic or huge tonnage one, because it usually deals with massively produced building and refractory materials or the ones applied among others: in sanitary engineering including among others: porcelain, stoneware, roofing tiles and bricks. Porous ceramics includes clay products and refractory materials and is characterised by huge share of glassy phase surrounding crystalline components. Porous ceramics is characterised by 5-15% share of pores, after firing in high temperature, applied in order to drain water. It is composed also of cement and concrete made as a result of firing in high temperature, milling of a clinker achieved in that way into minute powder, and solidification and hardening after mixturing with water and minute sand – in a case of cement mortar, or with water, sand and aggregate – in a case of concrete. Ceramic materials applied among others in households belong to that group of ceramics.

Stoneware is ceramic material made out of stoneware clay with additives composed of SiO_2, Al_2O_3, potassium, sodium and ferric oxides, fired once or twice and usually glazed. Terracotta is fired ceramic material composed of refractory clay, feldspar, quartz sand and metal oxides (pigments) and characterised with huge wear resistance. Clinker is ceramic materials fired from ferruginous, calcareous and ferruginous, calcareous and magnesious clays of huge resistance and impact resistance, little porosity and absorbability. Porcelain is sintered ceramic material made of mullite, quartz and feldspar glaze and is divided into hard and soft paste. Porcelain is fired once (non-glazed) or twice (glazed and hard). Feldspar glaze are used usually to glaze, and overglazed colour to decoration. Faience is white or ivory ceramic material, porous and usually glazed with glaze characterised with the inclination of soaking up water and significantly less resistance of porcelain. It is made of faience clays with addictives among others of quartz, feldspar and is fired twice and then glazed. As time flows, faience glaze breaks, soaks up water and becomes permanently dirty. Semi-vitreous china-ware is ivory ceramic material having intermediate properties between porcelain and faience of smaller porosity and bigger resistance than faience. It is made of faience clay, silty substance (ca. 50%), quartz and feldspar, by firing once or twice in temperature lower than porcelain.

Almost in each Issue of Archives of Materials Science and Manufacturing papers concerning ceramic materials appear. That subject matter is then a subject of interest of numerous scientific centres and also it enjoys vivid interests of P.T. Readers. I invite then P.T. Authors for the presentation of their next papers which deal with ceramics, and also all other groups of engineering materials.

Prof. Leszek A. Dobrzański M. Dr hc
Editor-in-Chief of the AMSE
President of the WAMME
President of the ACMS&SE

Gliwice, in June 2008