

Preface

Ceramic materials are usually defined by specifying what they are not. They are called inorganic, because they do not consist of electrically neutral molecules—which are typical for organic compounds. They are also called non-metallic, because ceramics are characterised by a gap between allowed energy bands of valence electrons, a feature not existing in metallic materials.

Applications of ceramic materials are primarily determined by their inherent properties. Traditional ceramics take the advantage of immanent properties of minerals and rocks of the earth's crust. Clays, feldspars and quartz—are used to produce table, sanitary and other kinds of traditional ceramics, clays rich in limestone and quartz sand (margles) to make Portland cement clinker. Typical glass, the soda-lime-silica glass, is made by melting lime-, quartz- and soda-bearing raw materials. Natural magnesite, dolomite, fireclay are among rocks exploited to fabricate refractories. The range of properties has been widened by the advent of advanced ceramic materials, produced from synthetic compounds and deeply transformed natural raw materials. The advanced ceramic materials can be classified, according to the state of their valence electrons and chemical bond type, into four groups having similar immanent properties. Namely: (i). covalent semiconductors (including a.o. Si, SiC and GaP); (ii). Ionic semiconductors (including a.o. CdS, GaN and GaAs); (iii). ionic dielectrics (including a.o. BaTiO₃, Pb(Zr_yTi_{1-y})O₃ and Pb(Mg_{0.33}Nb_{0.66})O₃); (iv). covalent dielectrics (including a.o. Al₂O₃, ZrO₂, Si₃N₄, and diamond). Exploitation of advanced ceramic materials is often feasible if the materials acquire new useful properties by adequate processing.

The title “Introduction to Ceramics” indicates that the present book is intended not to be another of the numerous textbooks or compendia about ceramics but should complement them. In order to help the reader grasp the main points, it is written in the form of concise essays. A book like this seemed to be timely in view of the rising flood of information and the reigning lack of time for reflection, needed to convert information into knowledge. However, this is essential for making the right choices and acting effectively in a dynamic world we are living in. Groups for which such a book may be useful include senior undergraduates choosing studies direction, students of physics and chemistry who have to choose a specialization;

already specialized doctoral students and engineers to gain a broader perspective, and businessmen, because It is of key importance to make business-related decisions on the basis of a broad overview of issues. The broad range of potential readers require the use of plain language and the simplest explanations possible, while a knowledge of basic notions of physics and chemistry could be assumed here.

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Roman Pampuch

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Pampuch, R.

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