



Diffusion in Ceramics (Solid Mechanics and Its Applications)

Joshua Pelleg

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This textbook provides an introduction to changes that occur in solids such as ceramics, mainly at high temperatures, which are diffusion controlled, as well as presenting research data. Such changes are related to the kinetics of various reactions such as precipitation, oxidation and phase transformations, but are also related to some mechanical changes, such as creep.

The book is composed of two parts, beginning with a look at the basics of diffusion according to Fick's Laws. Solutions of Fick's second law for constant D , diffusion in grain boundaries and dislocations are presented along with a look at the atomistic approach for the random motion of atoms. In the second part, the author discusses diffusion in several technologically important ceramics. The ceramics selected are monolithic single phase ones, including: Al_2O_3 , SiC, MgO, ZrO_2 and Si_3N_4 . Of these, three refer to oxide ceramics (alumina, magnesia and zirconia). Carbide based ceramics are represented by the technologically very important Si-carbide and nitride based ceramics are represented by Si-nitride which has been important in high temperature ceramics and gas turbine applications.

The author presents a clear, concise and relatively comprehensive treatment of diffusion in ceramics for use by those at an advanced undergraduate level and beyond. It supports understanding of the basic behavior of materials and how to relate observed physical properties to microscopic understanding. The book also provides researchers with a handy collation of data relating to diffusion in ceramics and supports a fundamental understanding of atomic movements.

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