Preface

Sustainability is an important issue all over the world. Carbon dioxide emission has been a serious problem in the world due to the greenhouse effect. Today many countries agreed to reduce the emission of CO_2. Many phases of cement and concrete technology can affect sustainability. Cement and concrete industry is responsible for the production of 7 % carbon dioxide of the total world CO_2 emission. The use of supplementary cementing materials (SCM), design of concrete mixtures with optimum content of cement, and enhancement of concrete durability are the main issues toward sustainability in concrete industry.

The aim of this book is to present the latest findings in the properties and application of supplementary cementing materials and blended cements currently used in the world in concrete. It consists of eight chapters. The book opens with the Chap. 1 on natural pozzolans, a material which has been used for over 2500 years. This is followed by the Chap. 2 on fly ash, a by-product of the combustion of pulverized coal and the most consumed artificial pozzolans in the cement industry all over the world. The Chap. 3 deals with the granulated ground blast furnace slag, a by-product of the metallurgical industry used as a hydraulic binder in large projects located in severe environments. In Chap. 4, silica fume a by-product in the production of silicon and silicon alloys and a super pozzolan for enhancement of concrete durability is discussed. The Chap. 5 deals with metakaolin (MK), commercially available since the mid-1990s, and one of the recently developed supplementary cementing materials. Metakaolin differs from other supplementary cementitious materials (SCMs), like fly ash, silica fume, and slag, in that it is not a by-product of an industrial process. It is produced by heating kaolin, one of the most abundant natural clay minerals, to temperatures of 650–900 °C. Rice husk ash (RHA), an artificial pozzolan from the combustion of rice husk in a control process and a very reactive material is explained in the Chap. 6. Increasing the rice production and the usage of rice hull in electricity generation and also incorporation of rice husk ash in concretes with enhanced durability, are the main reasons for the better future of rice husk ash. The Chap. 7 deals with the properties of Portland limestone cements. Perhaps the main advantage of producing Portland-limestone cements is that by introducing limestone into cement, the total volume of cement would increase, or in other words, the amount of clinker required to produce a certain amount of cement would decrease. This would result in a substantial amount of energy saving in the production of cement

as the consumption of natural raw materials and the fuel needed for production of clinker would be reduced. Finally, the role of supplementary cementing materials on sustainable development is included in the Chap. 8 of this book. Supplementary cementing materials have proven to be economic environmental alternatives to typical concrete mixes. More researches are needed for further applications of supplementary cementing materials to reduce energy consumption for the production of clinker cements and reduction of carbon dioxide emission in the cement and concrete industry.

Each chapter begins with a introduction followed by production, physical, chemical, and mineralogical properties, hydration reactions and pozzolanic activity, effects on properties of fresh concretes, effects on the mechanical properties of hardened concretes, effects on durability of concretes and their applications in concrete.

Author has tried to include his 35 years of experience in the field of concrete technology specially the engineering properties and durability of concretes containing cement replacement materials in this book. The author's findings on natural and artificial pozzolans in numerous research projects in Iran and all over the world during these years are discussed in different chapters.

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