

Preface

This is the inaugural volume of the book series “Engineering Materials for Technological Needs”. The technological needs relevant to this series include those that are related to the electronic, optical, magnetic, thermal, electrochemical, energy, environmental, structural, construction, aerospace, automobile, security, manufacturing and medical industries. Each book in the series addresses materials that serve various functions in a particular area of technological need by describing the relevant scientific concepts, the status of the technological need, the limitations of the technology, the pros and cons of the materials available, how the materials are applied, evaluated and fabricated, how various materials are integrated to form an assembly that can be used in practice, the performance and durability of the competing materials for each specific application, and the future directions.

The books in this series differ from other books in their emphasis on materials for technological needs. Existing books in the materials area largely focus on the fundamental science of particular classes of materials. The material classes in these existing books tend to be distinguished from the viewpoint of science rather than the viewpoint of applications. In contrast, from the viewpoint of a particular application, the relevant materials may include metals, polymers, ceramics, composites and semiconductors, which constitute the traditional classes of materials. The impetus of scientific research hinges on the success of applications. It is important to develop materials for applications rather than just studying materials for the sake of advancing the science of materials. In spite of the obvious importance of the linkage between science and applications, this linkage has long been weak, due to insufficient communication between the science community and the application community. This book series is intended to alleviate this problem by addressing materials from an application perspective. The books do not assume prior knowledge of the applications and require

from its readers the equivalence of only one introductory course in materials science. Due to the tutorial nature of the books in the series, the books are expected to be useful as textbooks in undergraduate and graduate levels. In addition, due to the timeliness and importance of the topics and to the inclusion of an up-to-date list of references, these books are expected to be used by professionals as reference books as well.

This book (Vol. 1 of the series), titled “High Performance Construction Materials: Science and Applications” and edited by Dr. Caijun Shi and Professor Y. L. Mo, is intended to provide scientific and practical information on a wide range of construction materials. In U.S.A., a large fraction of construction cost is for the repair and restoration of the existing infrastructure. The main reasons for the limited durability include the use of unsuitable materials and the improper use of materials. The latter usually relates to a flawed design. An example is the troubled Big Dig construction project in Boston. The development and application of high performance construction materials can enhance safety, extend the service life of the infrastructure and result in substantial cost savings and conservation of natural resources.

This book describes a number of high performance construction materials, including concrete, steel, fiber reinforced cement, fiber reinforced plastics, polymeric materials, geosynthetics, masonry materials and coatings. It discusses the scientific bases for the manufacture and use of these high performance materials. Testing and application examples are also included.

The collection of high performance construction materials covered in this book is covered in related books to limited degrees only. Books dealing with construction materials typically address traditional materials only and, as a consequence, they do not satisfy the increasing demands of today’s society. On the other hand, books dealing with materials science are not engineering oriented, with limited coverage of the application to engineering practice. This book reflects the great advances made on high performance construction materials in recent years. It is intended to apply relatively new high performance construction materials to design practice.

This book is appropriate for use as a textbook for courses in engineering materials, structural materials and civil engineering materials

at the senior undergraduate and graduate levels. In addition, it is suitable for use by practice engineers, including construction, materials, mechanical and civil engineers.

D.D.L. Chung
Book Series Editor
Buffalo, NY, U.S.A.
August 29, 2007