CIVIL ENGINEERING MATERIALS

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Civil Engineering Materials

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PREFACE

Materials science and engineering is a multidisciplinary area that is offered in undergraduate and graduate programs at many leading universities. It covers all engineering materials such as metals, ceramics, plastics, composites, and nanomaterials. When it comes to traditional engineering undergraduate programs such as civil, mechanical, electrical, or chemical engineering, their specific materials science educational needs are quite different. While civil engineers deal mostly with steel, concrete, timber, and soils, their mechanical engineering counterparts are interested in different alloys and composite materials. With rapid economic development and the scarcity of natural resources, the use of synthetic materials (e.g., polymers, composites), industrial by-products (e.g., slag, fly ash), recycled materials and their combinations with traditional materials (e.g., concrete and soils) has recently become more prevalent in civil engineering projects. Hence, there is a growing need for civil engineers to learn more about these advanced materials in addition to traditional materials.

Civil engineering mainly deals with the design and construction of civil infrastructure (e.g., dams, embankments, roads, buildings and bridges) and the provision of services such as water supply and sewerage. Civil engineering projects involve the use of various materials for design and construction. It is commonly expected that civil engineers have an in-depth knowledge of these conventional and advanced materials to select the materials sensibly, determine the material properties, and effectively carry out the design and construction.

Civil Engineering Materials covers all major traditional civil engineering materials through separate chapters. Sustainability is an important consideration these days among civil and construction engineering professionals. It is and will be a critical element in the material selection process. Chapter 13 discusses the sustainability, life cycle analysis, and other important issues relevant to civil and construction materials.

The civil engineering materials course is almost always taught in a broad-brush approach rather than providing comprehensive coverage. Generally, students learn the subject in the early years of a civil engineering program, and with the content covering a wide range of rather independent topics, it is necessary to provide a broad-brush treatment without relying on too many prerequisites. The students subsequently take more detailed courses in soils, rocks, concrete, steel, etc. that offer higher-level coverage.

All four co-authors are passionate about what we do in our respective areas, with excellent track records in teaching and learning. We are also active researchers who are up-to-date with the recent developments. Being young or young at heart, we have a good blend of experience; the young ones are eager to provide good taste and layout that is appealing to the new generation, and the senior ones take charge and contribute through their experiences. Having four co-authors with different backgrounds is one of the strengths here. This has enabled us to develop the chapters with genuine expertise in areas that we have been teaching for years.