Books

Materials Handbook: A Concise Desktop Reference

François Cardarelli
Springer Verlag London Limited, London, 595 pp., indexed, $75, 2000

The "Materials Handbook" presents information for materials selection for chemical processes. Information is given on corrosion, toxicity, costs, wear properties, strength, thermal stability and other aspects of important materials of construction for chemical process equipment. The Handbook is not meant to replace industry and service-specific standards and guidelines for materials selection. Rather, it acts as a starting place for detailed investigation of every type of construction material that a chemical, mechanical or electrical engineer might consider. The book is recommended for engineers involved in many different processes with an interest in materials selection and those desiring to understand the fundamentals behind materials behavior.

Each chapter covers a major class of materials. Separate chapters include appendices and a bibliography of major works in materials science. The bibliographic references are in addition to specific subject references included in each chapter.

Chapters cover ferrous metals and their alloys, common nonferrous metals, less-common nonferrous metals, semiconductors, superconductors, magnetic materials, insulators and dielectrics, miscellaneous electrical materials, ceramics and glasses, polymers and elastomers, minerals, ores, and gemstones, rocks and meteorites,: timbers and woods, building and construction materials, plus the appendices and a bibliography.

The material on metals, ceramics and glasses, polymers and elastomers, and timbers and woods is obviously the most apparently useful in chemical engineering. However, at least two other chapters include material relevant to most chemical engineers. The chapter on miscellaneous electrical materials includes a thorough introduction to the Seebeck Effect, thermocouple materials (temperature measurement), and anodes and cathodes (corrosion protection). The chapter on dielectrics includes information on piezoelectric materials (used in pressure- and weight-measurement devices).

Consistency in chapter organization runs through the book. A typical chapter includes general properties and description, occurrence, history, fundamental structural description behind the important properties, manufacturing processes, and description of commercially available materials and their properties. Much of the key engineering content of the book lies in the copious tables listing major engineering properties relevant to each material. In fact, the 229 tables cover approximately 340 pages of dense information.

Additionally, the included references at the end of each chapter bring the number of category sorted references and further reading sources to around 750. These cover every aspect of materials properties, processing and selection. References lead to detailed documentation required for selection between available material grades for specific services and conditions.

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Advances in Hydrogen Energy

Catherine E. Grelgoiro Padro and Francis Lau, editors
Kluwer Academic/Plenum, New York, 2000, 192 pp., $90

"Advances in Hydrogen Energy" is a compilation of fourteen papers that were presented as the Proceedings of an American Chemical Society 1999 Symposium on Hydrogen Production, Storage and Utilization. The U.S. Department of Energy sponsored ten of the projects described in these reports. Hydrogen is a high energy fuel that can be burned in a manner that does not generate the atmospheric pollutants NO_x and CO/CO_2, and is present on our planet in almost unlimited quantities.

Four of the studies review some of the frequently used commercial and semicommercial methods for making hydrogen. These include: steam reforming of natural gas or petroleum oil followed by the water-gas shift reaction; partial oxidation and thermal cracking of hydrocarbons; and the steam/iron process. These studies include methods of sequestering the carbon dioxide and carbon monoxide products to prevent these from entering the atmosphere and becoming so called greenhouse gases.

Five reports are description of experiments (or theoretical studies of processes) aimed at increasing the yield of hydrogen, using such techniques as catalytic reactions, plasma, removal of hydrogen from the water-gas shift reaction by a permeable membrane, and the study of semipermeable membranes to increase hydrogen recovery.

One paper reviews the possible methods for making hydrogen from coal. Several reports describe processes for generating hydrogen by the decomposition of metal hydrides (by reaction with water). Using these reactions allows the utilization of portable tanks containing reactants. Generally, the cost of hydrogen generated by these methods is high. One report describes a portable process for generating hydrogen by reacting a lithium hydride/oil slurry (from a portable tank) with water, then converting the lithium hydroxide byproduct back to the hydride in an external carbon thermal process.

Another paper models safety concerns associated with garaging a hydrogen-powered vehicle; another is on fuel cell batteries. Still another presents a study modeled a self-sustaining hydrogen generator using solar photovoltaic cells, a fuel cell and a battery. This book contains several approaches that could be taken to develop usable hydrogen generation processes.

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