

OVERVIEW

The *Department of Energy Fundamentals Handbook* entitled *Material Science* was prepared as an information resource for personnel who are responsible for the operation of the Department's nuclear facilities. An understanding of material science will enable the contractor personnel to understand why a material was selected for certain applications within their facility. Almost all processes that take place in the nuclear facilities involve the use of specialized metals. A basic understanding of material science is necessary for DOE nuclear facility operators, maintenance personnel, and the technical staff to safely operate and maintain the facility and facility support systems. The information in the handbook is presented to provide a foundation for applying engineering concepts to the job. This knowledge will help personnel more fully understand the impact that their actions may have on the safe and reliable operation of facility components and systems.

The *Material Science* handbook consists of five modules that are contained in two volumes. The following is a brief description of the information presented in each module of the handbook.

Volume 1 of 2

Module 1 - Structure of Metals

Explains the basic structure of metals and how those structures are effected by various processes. The module contains information on the various imperfections and defects that the metal may sustain and how they affect the metal.

Module 2 - Properties of Metals

Contains information on the properties considered when selecting material for a nuclear facility. Each of the properties contains a discussion on how the property is effected and the metal's application.

OVERVIEW (Cont.)

Volume 2 of 2

Module 3 - Thermal Shock

Contains material relating to thermal stress and thermal shock effects on a system. Explains how thermal stress and shock combined with pressure can cause major damage to components.

Module 4 - Brittle Fracture

Contains material on ductile and brittle fracture. These two fractures are the most common in nuclear facilities. Explains how ductile and brittle fracture are effected by the minimum pressurization and temperature curves. Explains the reason why heatup and cooldown rate limits are used when heating up or cooling down the reactor system.

Module 5 - Plant Materials

Contains information on the commonly used materials and the characteristics desired when selecting material for use.

The information contained in this handbook is by no means all encompassing. An attempt to present the entire subject of material science would be impractical. However, the *Material Science* handbook does present enough information to provide the reader with a fundamental knowledge level sufficient to understand the advanced theoretical concepts presented in other subject areas, and to better understand basic system operation and equipment operations.

