



Rare Earth Materials: Properties and Applications

A.R. Jha

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Recent studies indicate that China accounts for about 96 percent of the world's supply of rare earth materials (REMs). With REMs becoming increasingly important for a growing number of high-tech applications, appropriate action must be taken to mitigate the effects of a shortage of critical REMs in defense systems and components.

Bringing together information previously available only from disparate journal articles and databases, **Rare Earth Materials: Properties and Applications** describes the unique characteristics and applications of 17 REMs. It defines their chemical, electrical, thermal, and optical characteristics. Maintaining a focus on physical and chemical properties, it addresses the history and critical issues pertaining to mining and processing of REMs.

In this book, Dr. A.R. Jha continues his distinguished track record of distilling complex theoretical physical concepts into an understandable technical framework that can be extended to practical applications across commercial and industrial frameworks. He summarizes the chemical, optical, electrical, thermal, magnetic, and spectroscopic properties of REMs best suited for next-generation commercial and military systems or equipment. Coverage includes extraction, recycling, refinement, visual inspection, identification of spectroscopic parameters, quality control, element separation based on specific application, pricing control, and environmental / geo-political considerations.

Potential applications are identified with an emphasis on scientific instruments, nuclear resonance imaging equipment, MRI systems, magnetic couplers for uranium enrichment equipment, battery-electrodes, electric motors, electric generators, underwater sensors, and commercial and military sensors. The book describes unique applications of rare earth magnets in all-electric and hybrid electric cars and microwave components. It also considers the use of rare earth magnets in commercial and military systems where weight and size are the critical design requirements.

Suitable for both students and design engineers involved in the development of high-technology components or systems, the book concludes by summarizing future applications in electro-optic systems and components, including infrared lasers, diode-pumped solid-state lasers operating at room temperatures, and other sophisticated military and commercial test equipment

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