process. Oxygen levels for gathering impurities are controlled by computer. Epitaxial growth is widely used to form devices on Si wafers, and it is also controlled by computer. The processing steps, which include masking, photolithography, etching, diffusion, ion implantation, metallisation and oxidation, largely determine the performance and quality of the devices. The development of materials and processing in the semiconductor industry allows us to produce integrated circuits with a billion components contained in each chip, thus furthering the revolution in information technology which has reshaped our society.

The telecommunications industry is another example where functional materials play an extremely important role. The shift from electronic to optical technology required the development of many new optical materials. Optical fibres have to be very transparent to transmit light signals over a long distance. The development of new process technologies has resulted in silica optical fibres with transmission losses of 100 orders of magnitude lower ($\times 10^{-100}$) than ordinary optical glasses, and which approaches the theoretical minimum. Materials based on new systems, including fluorides, are being studied in an effort to further reduce the optical losses. However, new light sources and detectors will be needed as transmission frequencies make inroads into the infrared region.

1.4. Nature and Purpose of this Book

Engineers in all disciplines should have some basic and applied knowledge of materials in order to optimise their understanding and effectiveness. This textbook provides an introductory course for electrical engineering and other engineering-technology students. Its emphasis is on the application of materials in electric, electronic and telecommunication industries. A basic understanding of the relationships between processing, structure, properties and performance provides the tools and, therefore, the main purposes are as follows:

(i) To appreciate the importance of materials in modern technology.
(ii) To understand the basic principles of electronic properties of materials.
(iii) To familiarise the reader with the various groups of materials used in electrical and electronic industries.

With the above goals in mind, we will first focus on an understanding of a few basic principles of physical/electronic properties of materials. These principles will be used to discuss a wide range of properties, including electrical and electronic properties, magnetic properties, and optical and thermal properties. After examining such properties, the typical materials found in this group and brief processing techniques will be introduced. The applications of these materials will follow and will be emphasised and enhanced with case studies, where appropriate. It is hoped that this text will provide engineering students with an understanding of the basic concepts and some working knowledge of materials, and that it will be used as a general reference for reviewing electronic materials in the future.

This book has also been designed as a reference textbook at the introductory level for engineers and technologists whose work involves the design, improvement, maintenance, repair and/or use of electrical and electronic devices, instruments and equipment. A knowledge of and understanding of materials is necessary for all people working and living in our modern, technological society.