Diluted Magnetic Semiconductors (Vol. 25, Semiconductors and Semimetals)

Edited by Jacek K. Furdyna and Jacek Kossut

(Academic Press, 1988), 470 pages.
ISBN: 0-12-752125-9

Diluted magnetic semiconductors (DMS)—typically the tetrahedrally coordinated II-VI semiconductors such as CdTe in which the cations have been replaced by transition metal ions (e.g., Mn^{2+})—have attracted considerable attention from the scientific community in recent years, because of the DMS' striking magnetic phenomena owing to the large spin-spin exchange interaction between localized moments of the d electrons of the transition metal ion and the band electrons. For this reason and the fact that no other complete text exists on this subject, this work is a timely and valuable product.

There are three aspects of DMS properties that make these materials interesting subjects for scientific investigation. The first one is semiconducting properties per se; that is, how the band structures of host semiconductors can be varied by doping the transition metal ions. Second, purely magnetic properties of DMS encompass a very broad spectrum of behavior, including paramagnetic, spin-glass, and antiferromagnetic properties. Third, the large exchange interaction between localized magnetic moments and band electrons results in various remarkable features (i.e., the huge Faraday rotation of the visible and near infrared light in wide-gap DMS and the giant negative magneto-resistance near the semiconductor-semimetal transition in narrow-gap DMS).

This ten-chapter book provides excellent descriptions of these three aspects of DMS properties. The first two chapters describe the crystal structures, methods of preparation, and semiconducting properties (mostly optical) of DMS in the absence of magnetic fields. These are followed by two chapters devoted to the magnetic properties displayed by these materials. The remaining chapters deal with various aspects of the physical properties of DMS that are due to the sp-d interaction of the band electrons with localized magnetic moments. These include band structures, quantum transport phenomena, magneto-optics, shallow acceptor states, Raman scattering, and theory of bound magnetic polarons.

All the chapters are tutorial in nature, and thus the volume provides an exceptionally useful reference book. The authors of each chapter are well-known experts in their field. I recommend the book without reservation.

Reviewer: Hiroshi Kamimura is professor of theoretical physics, Department of Physics, and director of the Meson Science Laboratory, at the University of Tokyo. He is the past chairman of the Department and the chairman of the IUPAP Semiconductor Commission.

Characterization of Semiconductor Materials (Principles and Methods, Volume 1)

Edited by Gary E. McGuire

(Noyes Publications, 1989), approximately 328 pages.
ISBN: 0-8155-1200-7

As semiconductor integrated circuit technology advances to the submicron level and beyond, the need for advanced materials characterization methodologies will increasingly become more important. One can expect that with this increasing demand for semiconductor characterization technology, materials characterization costs will become a more significant fraction of silicon wafer production costs. This cost trend could result, if for no other reason, from such advanced wafer processing practices as single wafer processing with *in situ* surface analysis and characterization.

The analysis requirements in the semiconductor industry are certainly a challenge to the available analytical technologies. As Gary McGuire illustrates in this book, it is necessary to measure dopants at the ppm level and adventitious impurities at the ppb level not only in the bulk substrate material but also in metal, dielectric, and organic thin films and their interfaces. Electronic device scaling to smaller and smaller feature sizes has also played an important role in the rapid evolution in the microbeam analysis capabilities of many surface analysis tools. Without a doubt, the research, development, and manufacturing of semiconductor devices require an extensive array of analytical tools, not only for elemental determination and chemical state identification by chemical and microbeam methods but also for device parameter characterization by electrical measurements.

The need for a fundamental text, such as the subject of this review, that describes the various semiconductor materials characterization technologies, is clearly important for individuals operating in this field. This text serves as an appropriate primer for someone new to the field of semiconductor materials characterization, or as an exposure to advanced characterization methods for someone who has been in the materials characterization field in the semiconductor industry for some time.

Many of this book's chapters describe techniques that are used routinely in the field today, while other chapters describe analytical technologies that are emerging, or as yet, still very specialized in nature. Each contributing author has included a fairly comprehensive reference list in support of the analytical technology described. This book appears to meet the editor's stated desire to "provide a complete work that is a unique resource for individuals working in this field."

Reviewer: Ronald E. Pyle has his PhD in chemical physics from the Johns Hopkins University. He has been with Motorola Semiconductor Products Sector for more than nine years, and is currently manager of the MOS Analytical Laboratories, which provides reliability and materials characterization services to the MOS organization. □

FUTURE MRS MEETINGS

■ Fall Meetings ■

1990 November 26-December 1
Boston, Massachusetts

1991 December 2-7
Boston, Massachusetts

1992 November 30-December 5
Boston, Massachusetts

1993 November 29-December 4
Boston, Massachusetts

1994 November 28-December 3
Boston, Massachusetts

1995 November 27-December 2
Boston, Massachusetts

■ Spring Meetings ■

1991 April 28-May 3
Anaheim, California

1992 April 27-May 2
San Francisco, California

1993 May 17-22
Anaheim, California

1994 April 11-16
San Francisco, California

1995 To Be Announced

1996 April 22-27
San Francisco, California

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