is still premature for PWR thermal hydraulics. Then all that remains is to wait for the third edition of "Tong and Weisman."

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Physics of Modern Materials (Vols. I and II)
Lectures presented at an international course, Trieste, Italy, March 29–June 24, 1978

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Reviewer	J. C. Corelli

Physics of Modern Materials is a two volume series on lectures presented at an international course in Trieste, Italy, March 24-29, 1978. The two volumes are based on lectures of two dozen authors from a dozen different nations.

Volume I

The paper by Eades contains a valuable introduction to the study of diffraction in solids by x rays, neutrons, and electrons followed by an easily readable discussion of electron beam microscopy and its usefulness in yielding insights on the nature of defects generally in solids. The paper also contains a useful bibliography on a contemporary group of specially selected review papers on characterization of materials by electron microscopy (transmission electron microscopy, scanning electron microscopy, etc.).

A review of basic theory and experimental methods of crystal growth and doping including growth by pulling from liquid solutions, zone melting growth from vapor phase, epitaxial growth, and chemical methods from liquid phase is presented in an easily understandable fashion with ample illustrations making it easy for the reader to follow the arguments made by the author, C. Paorici, on the theory of ingrown defects in crystals (dislocations, diffusion, etc.). The paper contains a very good overview of descriptions of experimental methods used in crystal growth and crystal refining of electronic materials and semiconductors (CdTe, silicon, CdS). The addition of materials fabrication for nuclear reactor applications, e.g., Zircaloy and oxide fuel elements, would have greatly enhanced the usefulness of the paper by Paorici for persons interested in nuclear materials. However, the inclusion of nuclear metallurgy may have been outside the scope of the conference, and thus was omitted. Overall the paper is extremely helpful in bringing the uninitiated researcher in the field of crystal growth up to speed easily.

The paper by J. Friedel is a well-written description of extended defects of one and two dimensions. Dislocations and grain boundaries and magnetic walls are treated and their geometry and electronic structure and mobility are analyzed. An adequate bibliography is given for the reader wanting more specific details. Beginning with a review of simple defects, Friedel proceeds in an orderly and clear manner to direct the reader to the treatment of more complex defects of amorphous structures, stacking faults, and grain boundaries. After an easy to follow discussion of bonding in crystals, Friedel treats the various types of disorder in different crystal types including liquid and amorphous phases, then proceeds to the next level of complexity, which includes such planar defects as magnetic walls and direction of magnetization in ferromagnetic solids, grain boundaries, dislocation lines, and stacking faults. The method to calculate energy of a grain boundary as "a wall" (in stacking faults) is treated using electronic structure properties of valence electrons for metals, transitional metals and solids having covalent and ionic bonding. The methods for calculating strain energies due to various dislocations in both isotropic and anisotropic elastic solids and single crystals is clearly described and easy to follow with adequate illustrations.

Friedel treats stress-strain curves for various metal crystal structures and their relationship to plastic properties (creep, hardening, slip). Dislocations and covalent bond structures of diamond-type lattices (germanium, silicon) are treated briefly, and the paper concludes with a brief discussion of the interaction of line and wall "defects" and the plastic properties of amorphous phases of materials at low temperature.

The chapter on "Radiation Damage in Metallic Reactor Materials" by H. Ullmaier and W. Schilling contains an informative and relatively complete introduction and description of the terms, concepts, and theory of atomic displacement effects in metals including a discussion of helium and hydrogen gas production by neutron transmutation reactions. The chapter is written in a succinct manner. These authors give an interesting discussion of dynamic properties of interstitials and vacancies and their interaction with impurities complete with understandable models and illustrations. Calculations on the elastic interaction of defects and kinetics of annealing are outlined and then conveniently followed up by experimental evidence on the influence of radiation-induced defects on structure sensitive properties such as swelling, voids and dimensional changes, microstructure, and creep. The inclusion of examples of radiation-enhanced diffusion, fatigue and embrittlement of Type 316 stainless steel and molybdenum-base alloy (TZM) is useful in providing the nonspecialist a quick survey of the field albeit taken from papers published prior to June 1978. The chapter concludes with a brief and concise statement on the requirements on materials to be used in light water, breeder, and fusion reactors of the future.

The chapter by D. McLean entitled "Fracture Mechanics–The Physics of How Things Break" treats classical linear fracture mechanics starting with Griffith's criteria for crack growth and fracture. A detailed discussion and numerous examples are given in the method and tests for obtaining experimental data on fracture for comparison to calculation specifically for various ductile steels. The test methods for fracture mechanics include, for example, *R* curves (that is, resistance to extension by a crack grows as the extension grows), crack-opening displacement (that is, the additional opening of crack during loading), and the J integral (a method of integrating a mathematical function describing stress-strain outside the elastic region from one side of the crack to the other over certain pathways). Examples of fracture are given for various materials including steels, wood, and concrete. The influence of temperature on fracture processes (flow stress) is given for a wide variety of materials including polyethylene, rocks, glass, aluminum, diamond, and Fe-Ni-Cr alloys, which are extremely useful in obtaining an overall perspective. While the paper by McLean discusses fatigue, it is lamentable that only one paragraph is devoted to finite element analysis of fracture.

Laws' chapter on the "Elastic Response of Composite Materials" is a tutorial exercise by the author containing many problems, which are intended to extend the discussion of how to calculate and predict moduli. This chapter would be most useful to students taking a course in elasticity of solids at the advanced undergraduate level. The practitioner in the field would find the tabulation of various formulas useful.

Finally, the last chapter in Vol. I is a brief description of the "Thermoviscoelastic Effect" by Caglioti and Bottani in which lattice dynamics are used as the framework for the theory to interpret results. A comparison of measured values of Gruneisen parameter with other published values is presented for various solids (aluminum, copper, titanium, and a SiCr steel and alpha brass) and agreement with other data is fair.

Volume II

The first part of the second volume of this series contains papers on the structure and cohesion of transition metals and alloys, magnetism and rare-earth alloys, and superconducting materials. The chapter on superconductors is a lecture on the nature and characteristics of the superconducting state; it contains no references and is of limited use to designers of superconducting magnets.

The bulk of Vol. II is concerned with the electronic description of semiconductor materials in both the amorphous and crystalline state including magnetic semiconductors, basic theory of operation and construction of semiconductor devices [e.g., metal oxide semiconductor (MOS)], impact avalanche transit time diodes (IMPATT diodes), integrated circuit constituents [e.g., the insulated-gate field-effect transistor (IGFET device)], optoelectronic materials and devices as used for example in Kerr cells, solid state lasers, modulation, and switches. The paper by Kostadinov on the theory of disordered materials is useful in understanding the behavior of amorphous semiconductors, and glasses. The volume ends with papers on a symposium on classical fluids in honor of Prof. Ivar Waller. This includes papers on optical and neutron scattering by liquids, theory of the structure of simple liquids, and the properties of liquids in the form of molten salts.

Overall, Vol. I appears to be extremely useful and a valuable textbook addition to those researchers and teachers having a main interest in nuclear fusion and fission reactor materials systems. While Vol. II is of limited usefulness to nuclear materials researchers, it probably would be welcomed by research workers and students who are involved in electronic device work and require an understanding of what makes electronic devices work.

The two volumes would be an excellent addition to any library serving the broad range of disciplines mentioned above.

John C. Corelli is professor and executive officer in the Department of Nuclear Engineering at Rensselaer Polytechnic Institute with major responsibility being the curriculum at the bachelor and master levels. His main research interests are fusion-reactor-simulated radiation effects in ceramic materials SiC, Si_3N_4, etc. and their implication in first wall design, radiation alteration of polymer materials, neutron and ion radiation effects in silicon, and its implication for the operation of devices and circuits.

Nuclear Disaster in the Urals

Author	Zhores A. Medvedev
Publisher	Random House, New York (1980)
Pages	214
Price	$2.95
Reviewer	Dennis D. Patton

In the winter of 1957-58 there was a devastating accident involving a major Soviet military nuclear facility. Buried nuclear waste generated an uncontrolled reaction that liberated hundreds of thousands of curies of fission products, rendering an area of over 1000 km^2 uninhabitable. Several hundred people were killed and thousands were evacuated and hospitalized. A highly developed industrial region had to be deserted because of high radiation levels. The extent of the contamination is underlined by the fact that many sizable communities listed on earlier maps were completely deleted in later versions. Highway travel through this area is still strictly controlled, and entry into some areas is forbidden. News of this disaster was suppressed by the Soviets from the beginning, and the accident remained unknown to many Westerners for years.

Nuclear Disaster in the Urals is a remarkable work by Z. A. Medvedev, a former Soviet biologist who was working in the Soviet Union at the time of the disaster. Medvedev reviewed scientific articles written by Soviet biologists, physicists, and others who went into the devastated area studying the effects of the contamination on trees, plants, insects, and wildlife. By analyzing the reports, the author was able to piece together the magnitude of the uncontrolled release, which left lakes and land areas highly radioactive even years afterward. The book is an exciting piece of scientific detective work. Medvedev gives the reader a remarkable insight into the Soviet scientific community and its dealings with the Soviet government. It is a fascinating picture of the conflict between the natural curiosity of the Soviet scientists, eager to learn what was to be learned from this unprecedented catastrophe, and the rigid determination of the Soviet government officials that the catastrophe be kept an official secret. By interpreting not only what the Soviet scientists wrote, but what they obviously falsified or left out (or what was deleted by officials), Medvedev