

Abstracts of Papers by Bell System Authors Published in Other Journals

CHEMISTRY

Investigations of an Electrodeposited Tin-Nickel Alloy: II. Surface Passivity Studied with Auger Electron Spectroscopy. H. G. Tompkins and J. E. Bennett, *J. Electrochem. Soc.*, **123** (July 1976), pp. 1003-1006. This work investigates the surface film which is formed in air, using Auger electron spectroscopy and depth profiling. The surface film appears to be primarily a tin-rich oxide which is several atoms thick. The passive film which forms may not depend on the metastable nature of the alloy.

Time-Resolved Spectroscopy of Hemoglobin and Its Complexes with Subpicosecond Optical Pulses. C. V. Shank, E. P. Ippen, and R. Bersohn,* *Science*, **193** (July 2, 1976), pp. 50-51. Subpicosecond optical pulses have been used to study the photolysis of hemoglobin complexes. Photodissociation of carboxyhemoglobin is found to occur in less than 0.5 picosecond. In hemoglobin and oxyhemoglobin, a nondissociative excited state recovery in 2.5 picoseconds is observed. *Dept. of Chemistry, Columbia University.

ELECTRICAL AND ELECTRONIC ENGINEERING

Microwave Switching by Picosecond Photoconductivity. A. M. Johnson and D. H. Auston, *IEEE J. Quantum Electron.*, **QE-11** (June 1975), pp. 283-287. Bulk photoconductivity produced by the absorption of picosecond optical pulses in silicon transmission-line structures has been used to switch and gate microwave signals. The technique permits the generation of microwave and millimeter-wave pulses as short as a single cycle, and requires only a few microjoules of optical energy.

Transistor Design Considerations for Low-Noise Preamplifiers. R. B. Fair, *IEEE Trans. Nuc. Sci.*, **NS-23** (February 1976), pp. 218-225. A review is presented of design considerations for GaAs Schottky-barrier FETs and other types of transistors in low-noise amplifiers for capacitive sources. Ultimate limits of g_m/C and gate leakage currents are presented.

Wide-Band Matched Amplifier Design Using Dual Loop Feedback and Two Common Emitter Transistor Stages. T. J. Aprille, Jr., *IEEE Trans. Circuits Syst.* **CAS-23**, No. 7 (July 1976), pp. 434-442. Practical synthesis procedures for the design of shaped gain, wide-band, matched, dual loop feedback amplifiers that use a cascade of two common emitter transistor stages are treated. Circuits realized from these procedures are shown to be more than viable alternatives to existing single loop designs.

GENERAL MATHEMATICS AND STATISTICS

The Structure of a Utility Function Under Strong Risk Invariance. J. A. Morrison, *SIAM J. Appl. Math.*, **31** (July 1976), pp. 93-98. The utility function of a decision-maker who faces alternatives with multidimensional consequences, and acts as if to maximize his expected utility, is considered. The functional form of the utility function, under strong risk invariance, is determined in the case of nonconstant risk aversion, verifying a conjecture of R. Willig.

MATERIALS SCIENCE

Anodic Passivation and Coating of AlAs in Aqueous Solutions. W. D. Johnston, Jr., *J. Electrochem. Soc.*, **123** (March 1976), pp. 442-443. Uniform, stable oxide films have been grown on VPE deposited AlAs layers by anodization at constant current in pH 2.0 water. The oxide has refractive index ~ 1.8 and is suitable as a protective and anti-reflective coating for solar cells, LEDs, and other devices made from AlAs.

Enhanced Solubility and Ion Pairing of Cu and Au in Heavily Doped Silicon at High Temperatures. R. L. Meek and T. E. Seidel, *J. Phys. Chem. Solids*, **36** (1975), pp. 731-740. The equilibrium solubilities of Cu and Au in silicon have been calculated for high temperatures (900-1100°C) and heavy dopings (10^{19} - 10^{21} cm⁻³) and are

compared with experimental results for uniformly bulk doped and diffusion doped material. For strongly extrinsic *n* type material, a large solubility enhancement (about 10^3 times the intrinsic solubility) is calculated, due to ion pairing of the substitutional metal acceptor with donors. The saturation metal solubilities observed in bulk samples and diffused layers are in substantial agreement (within a factor of ~ 2) with calculations for all temperatures and doping levels.

Melting Point Depression and Kinetic Effects of Cooling on Crystallization in Poly(Vinylidene Fluoride)—Poly(Methyl Methacrylate) Mixtures. T. Nishi* and T. T. Wang, *Macromolecules*, 8 (November 1975), pp. 909-915. Melting point depression has been observed in mixtures of poly(vinylidene fluoride) and poly(methyl methacrylate). The phenomenon is ascribed to thermodynamic mixing of two compatible polymers. An appropriate expression is derived from which the interaction parameter for the polymer pair was found to be -0.295 at 160°C . * Bridgestone Tire Co., Ltd., Tokyo, Japan.

Probability of Static Fatigue Failure In Optical Fibers. D. Kalish and B. K. Tariyal, *Appl. Phys. Lett.*, 28 (June 15, 1976), pp. 721-723. An expression for the probability of static fatigue failure in glass is developed based upon a Weibull-type cumulative strength distribution and a fracture mechanics slow crack growth law. Good agreement between the model and experimental results is demonstrated. Examples for using this model as a predictive tool are presented.

Sputtering Techniques and Applications. A. K. Sinha, *Electron. Packag. Prod.*, 15, No. 8 (October 1975), pp. V10-V14. Important concepts are stated that should help understand and utilize sputtering technique for thin-film deposition. A state-of-the-art description is given of commercially available sputtering variants; namely, rf-diode sputtering, dc-diode sputtering, triode sputtering, and the magnetron sputter source. Effect of deposition variables is described on film composition, microstructure, and properties.

PHYSICS

Concentration-Dependent Absorption and Spontaneous Emission of Heavily Doped GaAs. H. C. Casey, Jr., and F. Stern, *J. Appl. Phys.*, 47 (February 1976), pp. 631-643. A model for the calculation of the absorption and emission spectra for GaAs at carrier concentrations in excess of $1 \times 10^{18} \text{ cm}^{-3}$ is described. Calculated absorption and emission spectra are compared to previous experimental results, which permits assignment of the concentration dependence of the energy gap. The concentration-dependent thermal equilibrium electron-hole density product and radiative lifetime are calculated for *p*-type GaAs.

Determination of the Stress in Optical Fibers by Means of a Polariscope. M. J. Saunders, *Rev. Sci. Instrum.*, 47 (April 1976), pp. 496-500. A polariscope is used in conjunction with a diameter-measuring instrument to determine the relationship between the tension of a Vycor-clad quartz fiber, as it is being drawn, and the diameter of the fiber. The polariscope is also used to determine the stress optical coefficient of optical fibers and preforms.

The Effects of Soft Modes on the Structure and Properties of Materials. P. A. Fleury, *Ann. Rev. Mat. Sci.*, 6 (1976), pp. 157-180. This paper reviews recent developments regarding the role of crystal lattice instabilities (soft modes) in structural phase transitions and the associated enhanced or anomalous physical properties of materials. Material systems considered include ferroelectrics, superconductors, and metastable alloys. Phenomena considered include light scattering, critical fluctuations, normal mode interactions, etc. Device applications of soft mode effects are discussed.

Metal-Induced Extrinsic Surface States on Si, Ge, and GaAs. J. E. Rowe, *J. Vacuum Sci. Technol.*, 13 (January/February 1976), pp. 248-250. Evidence for extrinsic metal-induced empty surface states during the Schottky-barrier formation on Si(111), GaAs(111), Ge(111), and Ge(100) is obtained with electron-energy loss spectroscopy. UV photoemission spectroscopy provides similar evidence for occupied extrinsic states on Si(111). The anomalous results on (110) surfaces are discussed in terms of a simple structural model.

Optically-Induced Energy Level Shifts for Intermediate Intensities. P. F. Liao and J. E. Bjorkholm, *Opt. Commun.*, *16*, No. 3 (March 1976), pp. 392-395. We report measurements of optically-induced energy level shifts by nonresonant light at intermediate intensities in atomic sodium vapor. The intensity-dependence of the shifts departs substantially from the linear behavior predicted by second order perturbation theory, but is in good agreement with more exact calculations and yields 0.10 for the $3P_1$ - $4D$ oscillator strength.

Plasmon-Interband Coupling in Gallium Compounds. J. E. Rowe, J. C. Tracy, and S. B. Christman, *Surface Sci.*, *52* (1976), pp. 277-284. Electron energy loss spectra have been measured for metallic Ga and the semiconductor compounds GaSb, GaAs, GaP, and GaN. The intensity at the measured plasmon energy decreases with increasing ionicity of the compound semiconductor. This is explained by a simple model involving a coupling of plasmon oscillations and interband transitions.

Production of Stabilized Coloration in Alkali Halides by a Two-Photon Absorption Process. L. F. Mollenauer, G. C. Bjorklund, and W. J. Tomlinson, *Phys. Rev. Lett.*, *35*, No. 24 (December 15, 1975), pp. 1662-1665. We have measured the stabilized coloration produced from the conversion of U centers in KCl by means of a two-photon process. The measurements show that the coloration involves energy transfer via electron-hole pairs, rather than direct photoexcitation of the U centers. The absolute two-photon absorption cross section of KCl at $\lambda = 266$ nm was determined.

Pyroelectric Sign of LiIO_3 . E. H. Turner, *J. Appl. Crystallog.*, *9* (February 1976), p. 52. The sign of the total pyroelectric coefficient, p_3 of LiIO_3 is related to the absolute configuration. Using the piezoelectric sign convention, p_3 is found to be positive.

SYSTEMS ENGINEERING AND OPERATIONAL RESEARCH

On the Output of a GI/M/N Queuing System with Interrupted Poisson Input. H. Heffes, *Oper. Res.*, *24* (May-June 1976), pp. 530-542. We characterize the departure process as a semi-Markov process and give results for the joint distribution of the number of customers in the system and the state of the input process at service completions. We also present results relating to the interdeparture time distribution and the distribution of the nonbusy period and compare the results with some known results for single-server systems.

