

Abstracts of Bell System Papers Appearing in Other Publications

Beginning with this issue, the Journal will publish abstracts of papers written by Bell System authors for other technical and scientific publications. We hope this new section provides you, our readers, with a reference source for articles covering the broad range of research and development in the Bell System.

CHEMISTRY

Heterogeneous Removal of Free Radicals by Aerosols in the Urban Troposphere. L. A. Farrow, T. E. Graedel, and T. A. Weber, ACS Symposium Series, Removal of Trace Contaminants from the Air, ed. Victor R. Deitz, 17, 1975, pp. 17-27. The effect of aerosols on atmospheric photochemistry has been evaluated in a computation of the gas phase chemistry of the urban troposphere for the northern New Jersey metropolitan region. It is shown that aerosol-radical interactions provide an efficient radical sink and stabilize the diurnal variation of radical concentrations.

The Influence of Aerosols on the Chemistry of the Troposphere. T. E. Graedel, L. A. Farrow, and T. A. Weber, I. J. Chem. Kinetics, Symposium No. 1, 1975; Proceedings of the Symposium on Chemical Kinetics Data for the Upper and Lower Atmosphere, pp. 581-594. Full kinetic calculations of the diurnal chemistry of the urban troposphere have been made using a formalism that includes the interactive effects of aerosols and free radicals. These effects are shown to be necessary to a unified analysis of atmospheric chemical reactions.

Liquidus-Solidus Isotherms in the In-Ga-As System. M. A. Pollack, R. E. Nahory, L. V. Deas, and D. R. Wonsidler, J. Electrochem. Soc., 122 (November 1975), pp. 1550-1552. Liquidus and solidus data are presented for the 800°, 850°, and 900°C isotherms in the In-rich corner of the In-Ga-As phase diagram. A simple solution model gives excellent agreement with the solidus data, but describes the liquidus more poorly than desired.

Ozone: Involvement in Atmospheric Chemistry and Meteorology. T. E. Graedel and L. A. Farrow, *Ozone Chemistry and Technology*, ed. J. S. Murphy and J. R. Orr, Philadelphia: Franklin Institute Press, 1975, pp. 165-175. The chemistry of ozone is closely related to virtually every gas phase chemical process that occurs in the troposphere and stratosphere of the earth. This paper reviews the current knowledge of ozone sources and sinks for the urban troposphere, the rural troposphere, the natural stratosphere, and the perturbed stratosphere.

The Synthesis and Characterization of Some Oxide Fluorides of Rhenium and Osmium. W. A. Sunder and F. A. Stevie, J. Fluorine Chem., 6 (November 1975), p. 449. Existing synthetic methods for oxide fluorides of rhenium and osmium have been reviewed. New syntheses, using static heating, have been developed for OsO_3F_2 , OsO_2F_3 , OsOF_5 , OsOF_4 , ReO_3F , ReO_2F_3 , ReOF_5 , and ReOF_4 . The products were characterized principally by mass spectroscopy, with supporting information for X-ray powder diffraction, chemical analysis, and molecular beam deflection.

ELECTRICAL AND ELECTRONIC ENGINEERING

Using Discretionary Telecommunications. D. Gillette, IEEE Trans. Commun., COM-23 (October 1975), pp. 1054-1058. Continuing technical effort can help reduce the cost of telecommunications and add opportunities for their use. However, the biggest task in application is organizing institutions and procedures to use existing telecommunications systems and information technologies effectively.

MATERIALS SCIENCE

Lead Alloys for High Temperature Soldering of Magnet Wire. W. G. Bader, *Welding Journal*, 54 (October 1975), Research Supplement, pp. 370-s to 375-s. Lead-tin solders were evaluated for use in high-temperature soldering of fine gauge, polyurethane-insulated, copper-magnetic wire. The dissolution rates of copper by molten solders were determined at temperatures to 900°F and the reduction of these rates by copper additions to the solder. Also, wetting of copper by the solders and solder joint appearance were evaluated.

GENERAL MATHEMATICS AND STATISTICS

Explicit Construction of Invariant Measures for a Class of Continuous State Markov Processes. S. Halfin, *Ann. Prob.*, 3 (October 1975), pp. 859-864. An explicit construction of invariant measures for a certain class of continuous-state Markov processes is presented. A special version of these processes is of interest in the theory of representation of real numbers (β -expansions). Previous results of Rényi and Parry are generalized, and an open problem of Parry is resolved.

Ridge Analysis Following a Preliminary Test of the Shrunken Hypothesis. R. L. Obenchain, *Technometrics*, 17 (November 1975), pp. 431-441 (with discussion by G. C. McDonald, pp. 443-445). Ridge analysis is a "new" form of multiple linear regression which can be helpful when the data are ill-conditioned (nearly multicollinear) and least-squares coefficients are highly intercorrelated. Utilizing the likelihood function for mean-squared-error optimality under normal distribution, a statistical test can detect situations where ridge analysis will be worthwhile.

PHYSICS

Aspects of the Band Structure of CuGaS₂ and CuGaSe₂. B. Tell and P. M. Bridenbaugh, *Phys. Rev. B*, 12 (October 15, 1975), pp. 3330-3335. The spin-orbit splitting has been determined in the sulfur-rich section of the system CuGaSe_{2-2x}Se_{2x}, which demonstrates that the spin-orbit splitting is negative in CuGaS₂. A model which provides adjustable coupling and separation between the *p*- and *d*-like valence band can account for the main features of the band structure of CuGaS₂ and CuGaSe₂.

Excitation of Transversely Excited CO₂ Waveguide Lasers. O. R. Wood II, P. W. Smith, C. R. Adams, and P. J. Maloney, *Appl. Phys. Letters*, 27 (November 15, 1975), pp. 539-541. Using a preionization scheme based on the Malter effect, small-signal gains >5%/cm at 10.6 μ m have been produced in a 1-mm² cross-section waveguide CO₂ amplifier at total operating pressures of 0.1 to 1 atmosphere. Comparisons between this preionization scheme and those using electron beams are made.

Dynamic Spectroscopy and Subpicosecond Pulse Compression. E. P. Ippen and C. V. Shank, *Appl. Phys. Letters*, 27 (November 1, 1975), pp. 488-490. Picosecond pulses from a mode-locked cw dye laser have been compressed in time to produce pulses as short as a few tenths of a picosecond. Dynamic spectroscopic investigations of the laser pulses reveal temporal asymmetry and frequency chirping on a subpicosecond time scale.

Frequency Dependence of the Electron Conductivity in the Silicon Inversion Layer in the Metallic and Localized Regimes. S. J. Allen, Jr., D. C. Tsui, and F. DeRosa, *Phys. Rev. Letters*, 35 (November 17, 1975), pp. 1359-1362. The conductivity of electrons in the inversion layer of silicon has been measured from 0 to 40 cm⁻¹ at 1.2°K in the metallic and localized regimes. The correlation between $\sigma(T)$ and $\sigma(\omega)$ in the localized regime suggests that the drop in conductivity at low electron concentrations is caused by the appearance of a gap at the Fermi level.

Elasticity Measurements in the Layered Dichalcogenides TaSe₂ and NbSe₂. M. Barmatz, L. R. Testardi, and F. J. Di Salvo, *Phys. Rev. B*, 12 (November 15, 1975), pp. 4367-4376. The Young's modulus and internal friction exhibit large anomalies at the commensurate charge-density wave (CDW) transition in 2H-TaSe₂. Hysteresis

effects ($\sim 5\text{K}$) verify the first-order nature of this transition. The incommensurate CDW transitions and the superconducting transition in 2H-NbSe_2 show weak elastic anomalies with essentially no hysteresis effects.

Interdiffusions in Thin-Film Au on Pt On GaAs (100) Studied with Auger Spectroscopy. C. C. Chang, S. P. Murarka, V. Kumar, and G. Quintana, *J. Appl. Phys.*, **46** (October 1975), pp. 4237-4243. Pt/GaAs heated *in vacuum* reacted initially by rapid Ga migration into Pt and formation of an As-rich layer at the Pt/GaAs interface. Ga eventually traveled entirely through even 9000 \AA Pt films, while As always stopped abruptly about $\frac{2}{3}$ way into the Pt. No Au was detected (<1 atom percent) in the Pt or GaAs after extensive Pt-GaAs reaction in Au/Pt/GaAs. Pt/GaAs heated *in air* behaved similarly, but developed a Ga-O layer over the Pt and an oxygen-rich layer at the Pt/GaAs interface.

Low-Threshold Room-Temperature Double-Heterostructure GaAs_{1-x}Sb_x/Al_yGa_{1-y}As_{1-x}Sb_x Injection Lasers at 1- μm Wavelengths. R. E. Nahory and M. A. Pollack, *Appl. Phys. Letters*, **27** (November 15, 1975), pp. 562-564. Double-heterostructure (DH) injection lasers based on the GaAs_{1-x}Sb_x/Al_yGa_{1-y}As_{1-x}Sb_x system have been fabricated using liquid phase epitaxial growth techniques and operated at room temperature at wavelengths in the $1\text{-}\mu\text{m}$ region. The observed room-temperature threshold current densities, as low as 2100 A cm^{-2} , are comparable to those of GaAs/AlGaAs devices of similar geometry.

Observation of Resonance Radiation Pressure on an Atomic Vapor. J. E. Bjorkholm, A. Ashkin, and D. B. Pearson, *Appl. Phys. Letters*, **27** (November 15, 1975), pp. 534-537. We have used the resonance radiation pressure from 40 mW of cw dye laser light propagating axially down a tube filled with sodium vapor to increase the sodium pressure (density) up to 50 percent over a length of 20 cm. The magnitude of the effect agrees well with measurements of the absorbed power.

Optical Pumping in Nitrogen Doped GaP. R. F. Leheny and Jagdeep Shah, *Phys. Rev. B*, **12** (October 15, 1975), pp. 3268-3274. Absorption saturation at the A bound exciton in GaP:N is described for a pulsed pump laser tuned directly to this absorption line and for a pump laser tuned above the indirect absorption edge. The second measurement yields 10-percent capture efficiency for N impurity. These measurements are analyzed by a model three-level system for the bound exciton by states.

Physical Properties of Poly(vinylchloride)-Copolyester Thermoplastic Elastomer Mixtures. T. Nishi, T. K. Kwei, and T. T. Wang, *J. Appl. Phys.*, **46** (October 1975), pp. 4157-4165. A study was made on the compatibility, thermal behavior, and mechanical properties of the poly(vinylchloride) blended with copolyester thermoplastic elastomer. Results from NMR, thermal expansion, tensile test, and dynamic mechanical measurements indicate extensive mixing of the segments of two polymers.

Torsional-Mode Losses at Contacts Between Homogeneous Fiber Waveguides and Supporting Structures. R. L. Rosenberg and G. D. Boyd, *J. Appl. Phys.*, **46** (November 1975), pp. 4654-4658. The losses from an ultrasonic torsional wave in a homogeneous fiber that are caused by contacts with fiber supports are found to depend primarily on contact area for a wide range of contact forces and materials. The associated force, compliance, and frequency dependencies are used to evaluate long-waveguide potentialities.

Volume Holograms in Photochromic Materials. W. J. Tomlinson, *Appl. Opt.*, **14** (October 1975), pp. 2456-2467. Theoretical expressions are derived describing the process of writing volume (or thick) hologram gratings in photochromic materials. The theory includes the effects of the saturation of the material response, scattering of the writing beams by the partially written hologram, and the refractive index changes that accompany the photoinduced absorption changes.

