mal fibers intermingled with occasional fibers in various stages of degeneration. As muscle degeneration advances, the concentration of CPK gradually decreases. This same pattern holds true for the dystrophic hamster (F. Homburger, C. W. Nixon, and J. R. Baker, Bio-Research Institute, Cambridge).

Many data are now available to indicate that serum enzyme determinations are valuable in detecting human dystrophic carriers (F. Schapira, J. Demos, G. Schapira, and J. D. Dreyfus, Hôpital des Enfants Malades, Paris), while the value of isoenzymes in the diagnosis of myopathies is still questionable (C. M. Pearson, University of California, Los Angeles). Studies of the sex-linked recessive sub-variety of the Duschenne type of dystrophy have indicated that a single routine estimation of serum CPK will identify about 70 percent of the female carriers of this disease. Serial estimates of serum enzyme before and after complete bed rest and strenuous exercise, as well as electromyographic recordings and muscle biopsies, are all helpful in identifying the remaining 30 percent (J. N. Walton and R. J. T. Pennington, Newcastle General Hospital, Newcastle-upon-Tyne).

The involvement of the heart muscle is a frequent complication in human progressive muscular dystrophy, and the cardiac disorder often advances to congestive failure. While myocardial degeneration in classic types of dystrophies usually develops during the late stages, a new type of muscular dystrophy has now been recognized which originates in the heart muscle (F. H. Norris, A. J. Moss, and P. N. Yu, University of Rochester). Myocardial lesions characterized by focal myolysis occur regularly also in the strain of dystrophic hamsters; in a large percentage of these animals (more than 90 percent), the cardiac involvement progresses to congestive heart failure (E. Bajusz, F. Homburger, and J. R. Baker, Bio-Research Institute, Cambridge, Massachusetts, and L. H. Opie, University of Oxford). Thus, this inbred line of Syrian hamsters provides not only the first opportunity for studies on the involvement of the cardiovascular system in a genetically determined myopathy, but it also presents a useful disease model for analysis of the mechanisms of congestive heart failure.

Two papers dealt with nutritional myopathies. It was suggested that one biological role of selenium lies in a selenium-containing compound which may be a carrier of vitamin E, and that selenium and vitamin E are somehow involved in sulfur metabolism (M. L. Scott, Cornell University, Ithaca). Finally, a myopathy responsive to vitamin E was reported to occur in the Rottnest Quokka; this reversible disease model proved to be valuable for the study of certain aspects of regeneration in muscle disease (B. A. Kakulas, University of Western Australia, Perth, and R. D. Adams, Massachusetts General Hospital, Boston).

In his concluding remarks F. Homburger stated that a good insight into the progress of studies of primary myopathies has been obtained. None of the basic problems has been completely solved, but there is now much wider recognition of the necessity to relate biochemical findings to functional observations, and to correlate morphologic and chemical abnormalities. This changed approach alone indeed constitutes great progress.

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Chemistry at High Temperatures

Several reasons exist for continuing and expanding high-temperature research. There are serious gaps in our knowledge of chemical and physical phenomena in the energy range of 0.1 to 10 electron volts (corresponding to thermal energies in the range of 1000 to 100,000°K). Syntheses of many unfamiliar and interesting compounds are now feasible through the use of high-temperature and high-pressure techniques. Definitive theories of chemical bonding and of molecular interactions require knowledge of thermodynamic properties, molecular parameters, and transport properties extended to conditions attainable only at extremes of temperature. Thus, John L. Margrave (Rice University) introduced a conference on the present and future problems in chemistry at high temperatures, held at Rice University, Houston, Texas (26–27 January 1966). The conference, attended by 46 invited participants, was sponsored by the Committee on High Temperature Chemical Phenomena of the Division of Chemistry and Chemical Technology, National Academy of Sciences–National Research Council, with financial support from the Director of Chemical Sciences, Air Force Office of Scientific Research.

Margrave, the chairman of the sponsoring committee, went on to describe work in progress at his laboratory, including particularly the synthesis and properties of uncommon fluorides for a variety of elements (CF, SiF_2, perfluorosilanes, monofluorides of the transition and rare-earth elements, and others).

Experimental atomic energy data obtainable at high temperatures by spectroscopic techniques can account for the crystal structures of the metallic elements (Leo Brewer, University of California, Berkeley). However, experimental spectroscopic data are lacking for many important diatomic molecules even in their ground states. Myron Kaufman (Harvard University) outlined new techniques for determining molecular properties of high-temperature species. Kaufman and William Klemperer have detected both electric and magnetic deflection from molecular beams, and thus have gained information about the polar character and paramagnetic properties of such materials as BaO, SiO, and LaO. William Weltner, Jr. (Union Carbide Corporation) discussed matrix-isolation of high-temperature molecules, such as the monoxides of the transition metals, and mentioned techniques for obtaining absorption spectra and electron-spin resonance spectra of the molecules trapped in solid argon, neon, and other media. Promising results were obtained by W. A. Chupka (Argonne National Laboratory) with the mass spectrometer for ions produced by photoionization. Thresholds for the photon-induced processes can be determined with a precision of 0.01 electron volt.

S. S. Penner (University of California, San Diego) discussed problems related to the interface between gas dynamics and chemical kinetics. Such problems are encountered in combustion and propulsion engines, planetary entry phenomena, gas-dynamic techniques adapted to the chemical process industries, and the design and manufacture of chemical propellants. For example, in the exhaust from a rocket, chemical reactions may be taking place with the temperature changing at the rate of 10^4 degrees per second. The feasibility was noted of a "comprex" engine for producing chemicals with the aid of repeated shocks, a case in point being the production of acetylene from methane and air raised to transient high temperature by this means. The principles involved and

the experimental data needed for the study of re-entry ablation and wake chemistry of high polymers, composites, and refractory materials were noted by John I. Slaughter (Aerospace Corporation). Much of the existing high-temperature and high-pressure data are unreliable. A particular problem requiring research is the generation of free electrons and negative-ion formation in high-temperature chemical reactions. L. S. Nelson (Sandia Corporation) described the possibilities of experimentation with condensed-phase microspecimens (linear dimensions in the range of 1 to 1000 microns), suddenly raised to high temperatures by means of intense thermal pulses (produced by shockwaves, various electromagnetic-radiation sources, capacitor discharges, or chemical heating methods, such as flames or explosions). An example cited was the production of tungsten vapor at close to 7000°K by flash-lamp heating of fine wire. By a similar heating technique, the complex phenomena associated with the combustion of freely falling droplets of refractory metals, such as zirconium in oxygen and in air, have been studied at temperatures up to 3000°K. Harold L. Schick (Lockheed Missiles and Space Company) recommended expansion of the JANAF chemical thermodynamics tables to include higher temperatures (up to 20,000°K) and a wider range of molecular and ionic species. He also pointed out the need for chemical kinetics data at high temperatures, both for elementary gas reactions and for heterogeneous solid-gas reactions, and the need for transport and optical data on gases at high temperatures. He cited future applications, such as the contemplated Pioneer series of solar probes (approaching within 0.1 astronomical unit of the sun), and re-entry conditions faced on Mars. Schick also mentioned the possible value of a journal devoted to high-temperature research, and the possibility of courses and graduate specialization in this field.

Raymond F. Baddour (Massachusetts Institute of Technology) discussed chemical synthesis in plasmas from the engineering point of view. A kinetically controlled mechanism set up in the carbon-hydrogen system when subjected to a continuous electric discharge produces acetylene in much higher yield than that theoretically attainable under equilibrium conditions. In general, the plasma generates transient precursors (such as C_2H in the carbon-hydrogen reaction) which are capable of combining in a variety of ways during quenching. Significant progress could be made if the desired precursors could be generated at low gas temperature, to avoid the loss of energy entailed by quenching. Steps in this direction have been taken by the use of microwave discharges. Successful examples are the conversion of methane to acetylene and hydrogen, and the conversion of sulfur dioxide and oxygen to sulfur trioxide.

Daniel Cubiciotti (Stanford Research Institute) discussed vapor pressure measurements on refractory materials and pointed out that there are practically no experimental data on heats of fusion above 1500°K. He called attention also to the special problems generated by high thermal gradients and heat fluxes. Charles W. Beckett (National Bureau of Standards) expressed the need for a complete array of measurement techniques to provide for systematic surveys of the properties and reactions of materials at high temperatures. Systematic investigations of all technically important classes of compounds are needed as a basis for a wide variety of immediate and future applications. He called for action to put such a program of investigations into effect.

Research on the containment of liquid metals up to 5000°K and methods of estimating their physical properties were described by A. V. Grosse (Research Institute of Temple University). H. Tracy Hall (Brigham Young University) outlined an electronic principle for predicting the possible existence of "periodic" compounds capable of being formed under high temperature and high pressure (such as BN and B_2O, which have the same number of valency electrons per atom as diamond and graphite). S. J. Hruska (Purdue University) discussed the formation and growth of solids deposited from vapor on a substrate, and also the problem of crystal growth at low supersaturation in relation to crystal perfection. E. A. Gulbransen (Westinghouse Research Laboratories) described experimental studies of the rates of volatile oxide formation for certain important refractory elements (carbon, rhenium, molybdenum, tungsten, niobium, and tantulum) when exposed to oxygen at temperatures far below vaporization or melting. In the absence of a stable oxide film, reaction by these elements with oxygen is rapid. Only the enthalpy of activation (about 21 kcal $mole^{-1}$) hinders it from proceeding at the collision rate.

George B. Rathmann (3M Company) summarized the theories and techniques that had been outlined at the conference, calling attention to their possible military and commercial applications. New high-temperature techniques are still needed for a variety of problems; their development and evaluation should be a conscious objective of future programs in the field. Commercial organizations should come forward, pointing out their needs. Brief presentations were offered also by M. Bowman (Los Alamos Scientific Laboratory) on fundamental high-temperature knowledge needed for improved nuclear propulsion devices; by J. R. Soulen (Pennsalt Chemicals Corp.) on a systematic search for new inorganic compounds obtained by high-temperature, high-pressure syntheses; and by Paul W. Gilles (University of Kansas) on the high temperature behavior of several nontypical systems.

The papers presented at the conference, with summaries of the discussions, will appear in a special publication to be issued by the National Academy of Sciences–National Research Council.

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Forthcoming Events

May

24–26. **Solid Propulsion**, conf., Chicago, Ill. (Chemical Propulsion Information Agency, 8621 Georgia Ave., Silver Spring, Md.)

24–26. **Ultrasonic Testing** of Materials, 2nd intern. symp., Berlin, Germany. (Kammer der Technik FV "Maschinenbau," Clara-Zetkinstr. 115-117, 108 Berlin)

25. American Soc. for **Gastrointestinal Endoscopy**, Chicago, Ill. (B. H. Sullivan, Jr., 2020 E. 93 St., Cleveland, Ohio 44106)

25–27. Society of **Radiographers**, 20th annual conf., Brighton, England. (The Society, 32 Welbeck St., London, W.1, England)

25–27. **Sulfamic Acid** and Its Electrometallurgical Applications, symp., Milan, Italy. (R. Piontelli, Laboratorio di Elettrochimica, Clinica-Fisica e Metallurgia del Politecnico di Milano, 32 Piazza Leonardo da Vinci, Milan)