

- (1958) Some high-pressure, high-temperature design considerations: equipment for use at 100,000 atmospheres and 3000°C. *Rev. Sci. Instr.*, **29**, 267-75.
- (1960) Ultra-high-pressure, high temperature apparatus: The "Belt." *Rev. Sci. Instr.*, **31**, 125-31.
- (1960) U. S. Patent No. 2,941,248.
- HANNAY, J. B. (1880) On the artificial formation of the diamond. *Proc. Roy. Soc.*, **30**, 188-89.
- HANSEN, M. (1958) *Constitution of Binary Alloys*. McGraw-Hill Book Co., 2nd Ed., pp. 349, 374.
- HOFFER, L. J. E. AND W. C. PEEBLES (1947) Preparation and x-ray diffraction studies of a new cobalt carbide. *Jour. Am. Chem. Soc.*, **69**, 893-99.
- LANDER, H. (1955) *A.S.E.A. Journal*, Vasteras, Sweden, May-June 1955.
- AND E. LUNDAV (1960) Some observations on the synthesis of diamonds. *Arkiv. Kemi*, **16**, 1939-49.
- LONSDALE, K.; H. J. MILLEDGE AND E. NAVE (1959) X-ray studies of synthetic diamonds. *Mineral. Mag.*, **32**, 185-201.
- MITCHELL, R. S. AND A. A. GIARDINI (1953) Oriented olivine inclusions in diamond. *Am. Mineral.*, **38**, 136.
- MOISSAN, H. (1894) *Comptes Rendus*, **118**, 320.
- NEUBAUER, A. (1954) Theoretical principles of diamond synthesis. *Ang. Chemie*, **66**, (17), 18)
- 332-36
- ROSSIGN, F. D. AND R. S. JESSUP (1938) Heat and free energy of formation of carbon dioxide, and of the transition between graphite and diamond. *Jour. Res. Natl. Bur. Std.*, **21**, 491-513.
- STANSON, C. B. (1950) Twinning in the diamond. *Am. Mineral.*, **35**, 193-206.
- (1953) Synthesis of graphite at room temperatures. *Am. Mineral.*, **38**, 50-55.
- TOULANSKY, S. AND I. SUZUGAWA (1959) Spiral and other growth forms of synthetic diamonds: a distinction between natural and synthetic diamonds. *Nature*, **184**, 1526-27.
- (1960) Interferometric studies on synthetic diamonds. *Nature*, **185**, (4708), 203-04.
- WALKER, P. L. JR. (1962) Carbon—an old but new material. *Am. Scientist*, **50**, 259-93.
- WILLIAMS, A. F. (1932) *The Genesis of the Diamond*, London.
- WILSON, W. B. (1960) Device for ultra-high pressure high-temperature research. *Rev. Sci. Instr.*, **31**, 331-33.
- ZELTMAN, A., J. BRAVMAN AND H. HERMAN (1961) U. S. Patent No. 2,968,887.
- (1962) *Manuscript received, June 8, 1962.*

## ACKNOWLEDGEMENTS

man-Simon equilibrium curve for graphite and diamond; (j) trace impurities may result either from the inclusion of microscopic quantities of crystalline matter, or for selected elements such as aluminum and boron, as elemental substitutes introduced by post crystallization diffusion, and finally, (k) a lamellar microstructure represents a fluctuating environment of pressure or temperature (or both), with included matter between lamellae indicating severe fluctuation.

The assistance and cooperation of the following personnel at the U. S. Army Signal Research and Development Laboratory are most gratefully acknowledged: Dr. J. A. Kohn, D. W. Eckart, J. W. Mellihampp, F. J. Becker, G. F. Hageman, G. E. Tomes, and F. M. Plock. Without their help this work would not have been possible. Thanks also are expressed to Dr. H. H. Kedesdy, Director of the Electronics Division of the Institute for Exploratory Research of this Laboratory, for his confidence and encouragement during the course of this study.

## REFERENCES

- BERMAN, R. AND F. SIMON (1953) On the graphite-diamond equilibrium. *Zell Elektrochem.*, **59**, 333-338.
- BOVENKERK, H. P. (1961) Morphology and physical characteristics of synthetic diamond. *Am. Mineral.*, **46**, 952-63.
- F. P. BUDY, H. T. HALL, H. M. STRONG AND R. H. WESTORF, JR., (1959), Preparation of diamond. *Nature*, **184**, 1094-8.
- BUDY, F. P., H. P. BOVENKERK, H. M. STRONG AND R. H. WESTORF, JR. (1961) Diamond-graphite equilibrium line from growth and graphitization of diamond. *Jour. Chem. Phys.*, **35**, 2, 383-91.
- H. T. HALL, H. M. STRONG AND R. H. WESTORF, JR. (1955) Press release, USA, February 15, 1955.
- DE CARLI, P. S. (1962) Personal communication, April 25, 1962.
- AND J. C. JAMESON (1960) Formation of diamond by explosive shock. *Science*, **133**, (3467), 1821.
- EVERSOLE, W. G. (1962) U. S. Patents Nos. 3,030,187 and 3,030,188.
- GIARDINI, A. A., J. A. KOHN, D. W. ECKART AND J. E. TYDINGS, (1961), Formation of coesite and kyanite from pyrophyllite at very high pressures and high temperatures. *Am. Mineral.*, **46**, 976-82.
- AND J. E. TYDINGS (1959) High-pressure high-temperature research and new electronic materials. *Proc. I. R. E. Confr. Elect. Components*, 148-54.
- (1961), U. S. Patent No. 2,995,776.
- J. A. KOHN AND D. W. ECKART (1961) Diamond synthesis: experimental procedure and reaction mechanisms between graphite and various metals at high pressures and temperatures. *Mineral. Soc. Am. Annual Conv.*, Cincinnati, Ohio.
- AND S. B. LEVIN (1960) A very high pressure-high temperature research apparatus and the synthesis of diamond. *Am. Mineral.*, **45**, 217-21.
- HALL, H. T. (1956) Chemistry at high temperature and high pressure. *Proc. High Temp. Symp.*, Berkeley, Calif., 161-166.