

## CONTENTS

Preface *S. Saito, O. Fukunaga, and M. Yoshikawa* v

### I. GAS PHASE DEPOSITION

Diamond Films: Synthesis, Properties and Some Fields of Application *B. V. Spitsyn* 1

Studies of Amorphous Hydrogenated "Diamondlike" Hydrocarbons and Crystalline Diamond *J. C. Angus, R. W. Hoffman, and P. H. Schmidt* 9

*In-Situ* Detection of Gaseous Species in the Filament-Assisted Diamond Growth Environment *F. G. Celii, P. E. Pehrsson, H.-t. Wang, H. H. Nelson, and J. E. Butler* 17

Study of Diamond Deposition from the Gas Phase Using Transmission Electron Microscopy *Y. Tamou, Y. Ohsawa, and N. Kikuchi* 25

Controlled Microstructure Diamond Films—Synthesis and Selected Applications *K. V. Ravi, L. S. Plano, M. Pinneo, M. Peters, and S. Yokota* 29

Conductivity of Polycrystalline Diamond Films *G. A. Sokolina, V. P. Varnin, and S. V. Bantsekov* 39

Diamond and Diamond-Like Carbon Films by the Ion Beam Sputter Deposition Technique *A. Ueno, M. Kitabatake, and K. Wasa* 43

Synthesis of Diamond Using a Combustion Flame in the Atmosphere *Y. Hirose* 51

Thick Diamond Films Grown by DC Discharge Plasma Chemical Vapor Deposition and Their Characteristics *M. Kamada, S. Arai, A. Sawabe, T. Kurakami, and T. Inuzuka* 55

Thick Diamond Film Synthesis by DC Plasma Jet CVD *M. Kawarada, K. Kurihara, K. Sasaki, A. Teshima, and N. Koshino* 59

Diamond Synthesis in a MW Plasma Jet *Y. Mitsuda and T. Yoshida* 65

Deposition of Diamond Film from the O<sub>2</sub>-CH<sub>4</sub> System *K. Tanabe, Y. Nishibayashi, T. Imai, A. Ikegaya, and N. Fujimori* 71

Crystallization of Diamond by Microwave Chemical Vapor Deposition *A. R. Badzian and T. Badzian* 79

Formation and Structural Features of Needle-Like Diamond *Y. Sato, C. Hata, and M. Kamo* 83

Diamond Deposition by Means of Tantalum Filament on WC-Co Alloy and Other Hard Materials *H. Matsubara and J. Kihara* 89

- Texture of Vapor Deposited Diamond Films as Revealed by Plasma-Etching *C. Hata, M. Kamo, and Y. Sato* 95
- Effect of Some Additives to the System CH<sub>4</sub>-H<sub>2</sub> on Diamond Deposition by Microwave Plasma CVD *C.-F. Chen, Y. C. Huang, S. Hosomi, and I. Yoshida* 101
- Diamond Synthesis by the Microwave Plasma CVD Method Using a Mixture of Carbon Monoxide and Hydrogen Gas *T. Ito, A. Masuda, Y. Eto, K. Ito, and K. Nishimoto* 107
- Characteristics of CVD Diamond Coated Inserts *H. Yoshimura, K. Nakahara, H. Yamashita, and N. Kikuchi* 111
- Nucleation Process of Diamond by Plasma CVD *S. Yugo, T. Kimura, and H. Kanai* 119
- Rapid Growth of Diamond Films by Arc Discharge Plasma CVD *F. Akatsuka and Y. Hirose* 125
- Thermal Properties of Sintered Diamond with Small Amounts of Metal *M. Akaishi, T. Ohsawa, S. Yamaoka, and O. Fukunaga* 129
- Polishing of Diamond Film with Metal *C.-F. Yang, H. Tokura, and M. Yoshikawa* 135
- Deposition of Diamond Film on a Sintered Diamond Surface and Its Application to a Cutting Tool *N. O-otake, H. Tokura, M. Yoshikawa, and C.-F. Yang* 139
- Morphology and Growth of Diamond Films *K. Miyata, K. Nishimura, K. Kobashi, Y. Kawate, and J. T. Glass* 145
- Gaseous Phase Synthesis of Diamond and Its Practical Application *F. Okuzumi, J. Matsuda, and K. O'oka* 149
- Selective Deposition of Diamond Crystals by Hot-Filament Method *K. Hirabayashi, K. Ikoma, Y. Taniguchi, and N. Iwasaki-Kurihara* 155
- Carburizing and Diamond Deposition on Titanium and Molybdenum Substrates with Plasma Jet under Reduced Pressure *O. Matsumoto and R. Furukawa* 161
- Preparation of Polycrystalline Diamond Films in a Parallel-Plate RF Deposition System *P. Wood, T. Wydeven, and O. Tsuji* 167
- Large Area CVD of Diamond Films Using Magneto-Microwave Plasma at Low Pressure *J. Suzuki, H. Kawarada, J. Wei, K.-S. Mar, Y. Yokota, and A. Hiraki* 171
- Large Area Diamond Deposition by Microwave Plasma CVD *K. Ishibori and Y. Ohira* 175
- The Synthesis of Diamond on Polycrystalline Graphite Substrates by Thermal CVD Method *Z. Jin, X. Lu, F. Huang, C. Qu, and G. Zou* 179
- Enlargement of Microwave Plasma Region and Diamond Deposition Area *M. Kamo, F. Takamura, and Y. Sato* 183

Deposition of Diamond from CH<sub>4</sub>-H<sub>2</sub> Plasma, (CH<sub>3</sub>)<sub>2</sub>CO-H<sub>2</sub> Plasma, and CO-H<sub>2</sub> Plasma in Microwave Discharge *H. Toshima, T. Kotaki, Y. Yaguchi, Y. Amada, and O. Matsumoto* 187

Multi-Shaped and Hybrid Diamond Particles by Vapor Phase Method *K. Komaki, M. Yanagisawa, I. Yamamoto, K. Arashida, and T. Fujimaki* 193

## II. HP/HT SYNTHESIS

The Manufacture and Application of De Beers Large Crystal Synthetic Diamond *R. C. Burns* 197

High Pressure Sintering of Diamond by Cobalt Infiltration *K. Uehara and S. Yamaya* 203

Preparation of c-BN Sintered Compact by Reaction Sintering under High Pressure *H. Itoh, T. Matsudaira, and S. Naka* 211

The Increase of Synthetic Diamond Growth Rate *N. V. Novikov and A. A. Shul'zhenko* 217

Crystal Growth of Cubic Boron Nitride Using Li<sub>3</sub>BN<sub>2</sub> Solvent and Morphology of the Grown Crystal *M. Kagamida, H. Kanda, M. Akaishi, A. Nukui, T. Osawa, and S. Yamaoka* 221

Effect of Gases Adsorbed on Raw Material on the Conditions of Diamond Formation *H. Uchikawa, H. Hagiwara, and K. Nakamura* 227

New Way of Lower HP Diamond Growth *A. Niedbalska, A. Szymański, and S. A. Zalewski* 229

Synthesis of Diamond from Amorphous Carbon under Static High Pressure *A. Onodera, K. Higashi, and Y. Irie* 235

Diamond Formation by a Solid State Reaction *S. Hosomi, Y. Nakamura, and S. Tanaka* 239

Diamond Compact of Nano-Sized Grains *K. Kondo and S. Sawai* 245

Sintering of Diamond Powder Electroless-Plated with Co Metal *T. Shige, S. Endo, E. F. Fujita, and Y. Tomii* 251

Effect of Recrystallized Graphite on the Nucleation of Diamond in Film Growth Reactions *G. Wang, Z. Zheng, and L. Chen* 257

## III. PHYSICAL AND CHEMICAL PROPERTIES

Some Mechanical Properties of Diamond—A Perspective View *C. A. Brookes, E. J. Brookes, and V. R. Howes* 261

Spectroscopic Studies of Synthetic Diamonds Grown by the Temperature Gradient Method *A. T. Collins* 273

Plasma Deposited Diamond-Like Films for IR Device Applications *R. S. Yalamanchi, C. L. Nagendra, and G. K. M. Thutupalli* 279

Thermister Made of Diamond Thin Film *H. Nakahata, T. Imai, H. Shiomi, Y. Nishibayashi, and N. Fujimori* 285

Blue and Green Cathodoluminescence of Vapour-Deposited Diamond Films Formed by Plasma CVD and Its Comparison with Bulk Diamond *H. Kawarada, K. Nishimura, Y. Yokota, Y. Mori, K. S. Mar, J. Wei, J. Suzuki, T. Ito, and A. Hiraki* 291

Cubic Boron Nitride PN Junction Diode Made at High Pressure as a High Temperature Diode and an Ultraviolet Led *O. Mishima, S. Yamaoka, O. Fukunaga, J. Tanaka, and K. Era* 297

Mechanical Properties of Diamondlike Carbon Films *N. Shohata, K. Fujii, S. Hoshino, H. Yamaguchi, Y. Tsukamoto, and M. Yanagisawa* 301

Thermal Properties of Boron Phosphide Single Crystalline Wafers *Y. Kumashiro, T. Mitsuhashi, S. Okaya, F. Muta, T. Koshiro, Y. Takahashi, M. Hirabayashi* 305

The Choice of Diamond for Some Scientific Applications *M. Seal* 311

Electron Microscopy of Diamond Films and Diamond/Substrate Interfaces *B. E. Williams, J. T. Glass, R. F. Davis, K. Kobashi, and K. L. More* 319

Ultra-High-Voltage Transmission Electron Microscope Observation of Diamond Particles Grown from Plasma-Assisted CVD *K. S. Mar, H. Kawarada, J. Suzuki, H. Mori, H. Fujita, and A. Hiraki* 327

Etching Characteristics of Carbon Films by RF Plasma *K. Kobayashi, Y. Shimada, N. Mutsukura, and Y. Machi* 333

Formation of Nitrogen Pairs in Synthetic Diamond during Growth *H. Kanda, T. Ohsawa, and S. Yamaoka* 339

The Electronic Structure of the Diamond Surface: Surface State Dispersion of Diamond (111) and (110) *B. B. Pate, J. Woicik, J. Hwang, and J. Wu* 345

Difference in Nitrogen Concentration & Aggregation among (111) & (100) Growth Sectors of Large Synthetic Diamonds *S. Satoh, H. Sumiya, K. Tsuji, and S. Yazu* 351

ESE and CW-ESR Studies of Synthetic Diamond Crystals: Distribution of Nitrogen and Nickel *J. Isoya, C. P. Lin, M. K. Bowman, J. R. Norris, S. Yazu, and S. Sato* 357

Color Centers in Synthetic Ib Diamonds and Their Application to Opto-Electronics *Y. Nishida, Y. Mita, S. Okuda, T. Mihara, R. Kato, M. Ashida, S. Sato, and S. Yazu* 363

Melting of Diamond *M. Togaya* 369

#### IV. MACHINING AND MECHANICAL PROPERTIES

New Diamond Forum—A Résumé of the Past or a Challenge for the Future of Diamond/CBN Tools *H. Wapler* 375

- Strength Properties Affecting Reliability of Diamond Tools *S. Shimada, N. Ikawa, G. Ohmori, and J. Uchikoshi* 383
- Measurement on Cutting Edge Radius of Single-Point Diamond Tools with Newly Developed SEM *S. Asai, Y. Taguchi, T. Kasai, and A. Kobayashi* 389
- Ion Beam Forming and Sharpening of Diamond Tools Having a Small Apex Angle *I. Miyamoto* 395
- Cutting Performance of Diamond Deposited Tool on Al-18 mass%Si Alloy *M. Yagi* 399
- Bonding of Diamond by Refractory Metal Coating *S.-H. Chen, L. K. Bigelow, J. T. Hoggins, and C.-M. Sung* 405
- MgO Interferometric Sensor for High Pressure Measurement under High Temperatures *N. M. Balzaretti, J. T. N. Medeiros, and J. A. H. da Jornada* 411
- The Manufacture of PDC for Cutting Tools *Z. Qi* 415
- The Stress Distribution in a Diamond Anvil at 5.5 Million Atmospheres *J.-a. Xu* 417
- The Cutting Performance of CBN Single Crystals in Precision Cutting of Hardened Steels *K. Tsuji, J. Degawa, and S. Yazu* 421
- Diamond Coating of Shearing Tools Using Burning Gas Flame *M. Murakawa, S. Takeuchi, and Y. Hirose* 425
- The Effect of the Type and Amount of the Grain Boundary Phase in S-Type Polycrystalline Diamond on Its Physical Properties *H. Yu and S. Li* 431
- Tough Crystal of Cubic Boron Nitride *E. Iizuka* 435
- A Study on the Oxidation Resistance of Sintered Polycrystalline Diamond with Dopants *D. Wang, Y. Xue, Q. Jiao, and P. Liu* 437
- Thermal Stability of Diamond Films *T. Obata and S. Morimoto* 441
- Raman Spectra of Diamondlike Amorphous Carbon Films *M. Yoshikawa, N. Nagai, G. Katagiri, H. Ishida, and A. Ishitani* 445
- Detection of Thermal Diffusivity for Thin Samples and Powder with Microphone-Photoacoustic Spectroscopy *M. Qian, T. Wu, L. Hou, P. Yang, and L. Qi* 449
- Laser Flash Method for Investigating the Thermal Diffusivities of Thin Films *P. Yang, L. Hou, and L. Qi* 453
- High Performance Electroformed Diamond Cutting Blades *N. Oikawa, T. Takahashi, and Y. Tsujigo* 457
- Ceramic Coating on Diamond Grains and Its Application to Grinding Wheels *H. Tokura and M. Yoshikawa* 463
- Cutting of Diamond Grit with YAG Laser *S. Tezuka, H. Tokura, and M. Yoshikawa* 469

An Ultraprecision Diamond Cutting Tool with a 50 nm Corner Radius Roundness for Aspheric Turning *K. Nishimura, H. Yoshinaga, S. Shimada, and N. Ikawa* 475

Thermal Conductivity of Synthetic Diamond Films *C. P. Beetz, Jr., T. A. Perry, and D. T. Morelli* 479