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Early Attainments of Porous Silicon Carbide Technology: a Bibliographic Digest

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Abstract. This work presents a bibliographic review on a promising functional material - porous silicon carbide (PSC). The work reviews selected sources, which describe the main achievements that formed the technological basis for PSC yet in the first decade of the 2000s, but were often ignored in the later research and publications. It is expected that this selection would be useful for specialists in semiconductor physics, engineers, and technologists working in this field.

REFERENCES

[1] A. Uhlir, *Electrolytic shaping of germanium and silicon*, Bell Syst. Techn. J., 1956, vol. 35, no. 2, pp. 333–347.
[2] H. Föll, J. Carstensen and S.Frey, *Porous and Nanoporous Semiconductors and Emerging Applications*, J. Nanomaterials, 2006, vol. 2006, art. 91635.
[3] L.T. Canhan, *Silicon quantum wire array fabrication by electrochemical and chemical dissolution of wafers*, Appl. Phys. Lett., 1990, vol. 57, no. 10, pp. 1046-1048.
[4] L.T. Canham, *Bioactive silicon structure fabrication through nanoetching techniques*, Adv. Mater., 1995, vol. 7, no. 12, pp. 1033-1037.
[5] V. Kochergin and H. Föll, *Biochemical Sensors Based on Porous Silicon*, In: *Porous Semiconductors. Engineering Materials and Processes* (Springer, London, 2009), pp. 197-206.
[6] G. Korotcenkov and B.K. Cho, *Porous Semiconductors: Advanced Material for Gas Sensor Applications*, Crit. Rev. Solid State Mater. Sci., 2010, vol. 35, no. 1, pp. 1-37.
[7] G. Gautier and P. Leduc, *Porous silicon for electrical isolation in radio frequency devices: A review*, Appl. Phys. Rev., 2014, vol. 1, no. 1, art. 011101.
[8] J. Hernández-Montelongo, A. Muñoz-Noval, J.P. García-Ruíz, V. Torres-Costa, R.J. Martín-Palma and M. Manso-Silván, *Nanostructured Porous Silicon: The Winding Road from Photonics to Cell Scaffolds – A Review*, Front. Bioeng. Biotechnol., 2015, vol. 3, art. 60.
[9] P. Griffin and R. Oliver, *Porous nitride semiconductors reviewed*, J. Phys. D: Appl. Phys., 2020, vol. 20, no. 38, art. 383002.
[10] E. Monaico, I. Tiginyanuet and V. Ursakial, *Porous semiconductor compounds*, Semicond. Sci. Technol., 2020, vol. 35, art. 103001.

[11] G. Tuci, Y. Liu, A. Rossin, X. Guo, C. Pham, G. Giambastiani and C. Pham-Huu, *Porous Silicon Carbide (SiC): A Chance for Improving Catalysts or Just Another Active-Phase Carrier?*, Chem. Rev., 2021, vol. 121, no. 7, pp. 10559-10665.
[12] Yu.M. Tairov and V.F. Tsvetkov, *General principles of growing large-size single crystals of various silicon carbide polytypes*, J. Cryst. Growth., 1981, vol. 52, no. 1, pp. 146-150.
[13] V.J. Jennings, A. Sommer and H. Chang, *The Epitaxial Growth of Silicon Carbide*, J. Electrochem. Soc., 1966, vol. 113, no. 7, pp. 728-730.
[14] W. von Muench and I. Pfaffeneder, *Epitaxial deposition of silicon carbide from silicon tetrachloride and hexane*, Thin Solid Films, 1976, vol. 31, no. 1-2, pp. 39-51.
[15] S. Yoshida, E. Sakuma, H. Okumura, S. Misawa and K. Endo, *Heteroepitaxial growth of SiC polytypes*, J. Appl. Phys., 1987, vol. 62, no. 1, pp. (1987) 303-305.
[16] Porous silicon carbide and gallium nitride: epitaxy, catalysis and biotechnology applications, ed. by R.M. Feenstra and C.E.C. Wood (John Wiley & Sons Ltd., England, 2008).
[17] R.L. Smith and S.D. Collins, *Porous silicon formation mechanisms*, J. Appl. Phys., 1992, vol. 71, no. 8, art. R1.
[18] J.-N. Chazalviel, R.B. Wehrspohn and F.Ozanam, *Electrochemical preparation of porous semiconductors: from phenomenology to understanding*, Mater. Sci. Eng. B, 2000, vol. 69-70, pp. 1-10.
[19] IUPAC Compendium of Chemical Terminology. Version 2.3.3 2014-02-24.
[20] A.M. Khort, A.G. Yakovenko and Y.V. Syrov, *An integral feature of porous silicon and its classification*, Condensed Matter and Interfaces, 2021, vol. 23, no. 3, pp. 440-444.
[21] J.S. Shor, R.M. Osgood and A.D. Kurtz, *Photoelectrochemical conductivity selective etch stops for SiC*, Appl. Phys. Lett., 1992, vol. 60, no. 2, pp. 1001-1003.
[22] J.S. Shor and R.M. Osgood Jr., *Broad-Area Photoelectrochemical Etching of n-Type Beta-SiC*, J. Electrochem. Soc., 1993, vol. 140, no. 8, pp. L123-L125.
[23] J.S. Shor, I. Grimberg, B.-Z. Weiss and A.D. Kurtz, *Direct observation of porous SiC formed by anodization in HF*, Appl. Phys. Lett., 1993, vol. 62, no. 22, pp. 2836-2838.
[24] J.S. Shor, L. Bemis, A.D. Kurtz, M. Macmillan, W.J. Choyke, I. Grimberg and B.Z. Weiss, In: *Silicon Carbide and Related Materials*, ed. by M.G. Spencer, R.P. Devaty, J.A. Edmond, M. Asif Khan, R. Kaplan and M. Rahman, Inst. Physics Conf. Ser. No. 137 (IOP, Bristol, 1993), p. 193.
[25] J.S. Shor, L. Bemis, A.D. Kurtz, I. Grimberg , B.Z. Weiss, M.F. Mac Millan and W.J. Choyke, *Characterization of nanocrystallites in porous p-type 6H-SiC*, J. Appl. Phys., 1994, vol. 76, no. 7, pp. 4045-4049.
[26] J.S. Shor and A.D. Kurtz, *Photoelectrochemical Etching of 6H-SiC*, J. Electrochem. Soc., 1994, vol. 141, no. 3, pp. 778-781.
[27] W.-H. Chang, B. Schellin, E. Obermeier and Y.-C. Huang, *Electrochemical etching of n-type 6H-SiC without UV illumination*, J. Microelectromech. Syst., 2006, vol. 15, no. 3, pp. 548-552.
[28] A.O. Konstantinov, C.I. Harris and E. Janzen, *Electrical properties and formation mechanism of porous silicon carbide*, Appl. Phys. Lett., 1994, vol. 65, no. 21, pp. 2699-26701.
[29] A.O. Konstantinov, A. Henry, C. Harris and E. Janzen, *Photoluminescence studies of porous silicon carbide*, Appl. Phys. Lett., 1995, vol. 66, no. 17, pp. 2250-2252.
[30] A.O. Konstantinov, C.I. Harris and E. Janzen, *Fabrication and Properties of High-Resistivity Porous Silicon Carbide for SiC Power Device Passivation*, Mater. Sci. Eng. B, 1995, vol. 29, no. 1-3, pp. 114-117.
[31] D.M. Collins, G.L. Harris, K. Wongchotigul, D. Zhang, N. Chen and C. Taylor, *Photoelectrochemical (PEC) Etching of n and p Silicon Carbide (SiC) and Its Characterization*, In: Tech. Digest of (ICSCRM-95), Kyoto, Japan (1995), p. 171
[32] J. Lagemaat, M. Plakman, D. Vanmaekelbergh and J.J. Kelly, *Enhancement of the light-to-current conversion efficiency in an n-SiC/solution diode by porous etching*, Appl. Phys. Lett., 1196, vol. 69, no. 15, pp. 2246-2248.
[33] O. Jessensky, F. Muller and U. Gosele, *Microstructure and photoluminescence of electrochemically etched porous SiC*, Thin Solid Films, 1997, vol. 297, no. 1-2, pp. 224-228.
[34] W. Shin, K. Ishida, W.-S. Seo, Y. Suzuki and K. Koumoto, *Luminescence from anodized microcrystalline silicon carbide*, Inst. Physics Conf. Ser., 1996, no. 142, pp. 1071-1075 (IOP: Bristol, UK, 1996).

[35] S. Zangooie, P.O.A. Persson, J.N. Hilfiker, L. Hultman, H. Arwin and Q. Wahab, *Microstructural, optical and electronic investigation of anodized 4H-SiC*, Materials Science Forum, 2000, vol. 338-342, pp. 537-540 (Trans Tech Publications, Ltd.).
[36] S. Zangooie, P.O.A. Persson, J.N. Hifiker, L. Hultman and H. Arwin, *Microstructural and infrared optical properties of electrochemically etched highly doped 4H–SiC*, J. Appl. Phys., 2000, vol. 87, no. 12, pp. 8497-8503.
[37] S. Zangooie and H. Arwin, *Porous Anodic 4H-SiC: Thickness Dependent Anisotropy in Pore Propagation and Ellipsometric Characterization*, phys. stat. sol. (a), 2000, vol. 182, no. 1, pp. 213-219.
[38] S. Zangooie and H. Arwin, *Surface, Pore Morphology, and Optical Properties of Porous 4H-SiC*, J. Electrochem. Soc., 2001, vol. 148, pp. G297-G300.
[39] S. Zangooie, J.A. Woollam and H. Arwin, *Self-organization in porous 6H–SiC*, J. Mater. Res., 2000, vol. 15, no. 9, pp. 1860-1863.
[40] A.M. Danishevskii, M.V. Zamoryanskaya, A.A. Sitnikova, V.B. Shuman and A.A. Suvorova, *TEM and cathodoluminescence studies of porous SiC*, Semicond. Sci. Technol., 1998, vol. 13, no. 19, pp. 1111-1116.
[41] A.M. Danishevski, V.B Shuman, A.Yu. Rogachev, E.G. Guk, P.A. Ivanov and A.A. Mal'tsev, *Appearance of β-phase crystallites in porous layers of silicon carbide*, Semiconductors, 1996, vol. 30, no. 6, pp. 564-567.
[42] L.M. Sorokin, N.S. Savkina, V.B. Shuman, A.A. Lebedev, G.N. Mosina and G. Hutchison, *Features of the structure of a porous silicon carbide layer obtained by electrochemical etching of a 6H-SiC substrate*, Tech. Phys. Lett., 2002, vol. 28, no. 11, pp. 935-938.
[43] A. Danishevskii, V. Shuman, A.Y. Rogachev and P. Ivanov, Investigation of porous silicon carbide by methods of vibrational and luminescence spectroscopy, Semiconductors, 1995, vol. 29, no. 12, pp. 1106-1111.
[44] Y. Shishkin, W.J. Choyke and R.P. Devaty, *Photoelectrochemical etching of n-type 4H silicon carbide*, J. Appl. Phys., 2004, vol. 96, no. 4, pp. 2311-2313.
[45] Y. Shishkin, W.J .Choyke and R.P. Devaty, *Triangular Pore Formation in Highly Doped n-Type 4H SiC*, Materials Science Forum, 2004, vol. 457-460, pp. 1467-1470 (Trans Tech Publications, Ltd.).
[46] H. von Bardeleben, J. Cantin, Y. Shishkin, R. Devaty and W. Choyke, *Microscopic Structure and Electrical Activity of 4H-SiC/SiO_2 Interface Defects: an EPR Study of Oxidized Porous SiC*, Materials Science Forum, 2004, vol. 457-460, pp. 1457-1460 (Trans Tech Publications, Ltd.).
[47] Y. Shishkin Y. Ke, R.P. Devaty and W.J. Choyke, *Fabrication and morphology of porous p-type SiC*, J. Appl. Phys., 2005, vol. 97, no. 4, art. 044908.
[48] Y. Shishkin, Y. Ke, R. Devaty and W. Choyke, *A Short Synopsis of the Current Status of Porous SiC and GaN*, Materials Science Forum, 2005, vol. 483-485, pp. 251-256 (Trans Tech Publications, Ltd.).
[49] Y. Shishkin, Y. Ke, R.P. Devaty and W.J. Choyke, *Self-Ordered Nanocolumnar Pore Formation in the Photoelectrochemical Etching of 6H SiC*, Electrochem. Solid-State Lett., 2007, vol. 10, no. 7, art. K24.
[50] M. Kayambaki, K. Tsagaraki, V. Cimalla, K. Zekentes and R. Yakimova, *Crystal Quality Evaluation by Electrochemical Preferential Etching of p-Type SiC Crystals*, J. Electrochem. Soc., 2000, vol. 147, no. 7, pp. 2744-2748.
[51] M. Mynbaeva, M. Kayambaki, K. Mynbaev and K. Zekentes, *On application of electrochemical capacitance–voltage profiling technique for n-type SiC*, Semicond. Sci. Technol., 2008, vol. 23, no. 7, art. 075039.
[52] L.M. Peter, D.J. Blackwood and S. Pons, In situ characterization of the illuminated silicon-electrolyte interface by Fourier-transform infrared spectroscopy, Phys. Rev. Lett., 1989, vol. 62, no. 3, pp. 308-311.
[53] J. Stumper, H.J. Lewerenz and C. Pettenkofer, *X-ray photoemission spectroscopy analysis of Si(111) under photocurrent-doubling conditions*, Phys. Rev. B., 1990, vol. 41, no. 3, pp. 1592-1597.
[54] A.A. Lebedev, Yu.V. Rud', V.Yu. Rud' and A.M. Strel'chuk, *Photosensitivity of structures in anodized layers of silicon carbide*, Tech. Phys. Lett., 1996, vol. 22, no. 9, pp. 715-716.

[55] A.A. Lebedev, A.A. Lebedev, Yu.V. Rud' and V.Yu. Rud', *Preparation and photosensitivity of heterostructures based on anodized silicon carbide*, Semiconductors, 1998, vol. 32, no. 3, pp. 295-296.
[56] A.T. Cao, Q.N.T. Luong and C.T. Dao, *Influence of the anodic etching current density on the morphology of the porous SiC layer*, AIP Advanc., 2014, vol. 4, no. 3, art. 037105.
[57] N.S. Savkina, L.M. Sorokin, J.L. Hutchison, J. Sloan, A.S. Tregubova, G.N. Mosina, V.B Shuman and V.V. Ratnikov, *Role of the defects under porous silicon carbide formation*, Appl. Surf. Sci., 2001, vol. 184, no. 1-4, pp. 252-256.
[58] M.C.D. Hobgood, M.F. Brady, M.R. Calus, J.R Jenny, R.T. Leonard, D.P. Malta, S.G. Müller, A.R. Powell, V.F. Tsvetkov, R.C. Glass and C.H. Carter Jr., *Silicon Carbide Crystal and Substrate Technology: A Survey of Recent Advances*, Materials Science Forum, 2004, vol. 457-469, pp. 3-8 (Trans Tech Publications, Ltd.).
[59] Fundamentals of Silicon Carbide Technology: Growth, Characterization, Devices and Applications, ed. by T. Kimoto and J.A. Cooper (Wiley-IEEE Press. 1st edition, 2014).
[60] M. Bakowski, P. Harris, C. Karlsson, S. Savage and A. Schoner, *Silicon Carbide Conference Report*, Compound Semiconductor, 2000, vol. 6, no. 8, p. 75.
[61] P.A. Ivanov, M.G. Mynbaeva and S.E. Saddow, *Effective carrier density in porous silicon carbide*, Semicond. Sci. Technol., 2004, vol. 19, no. 3, pp. 319-322.
[62] M. Mynbaeva, N. Bazhenov, K. Mynbaev, V. Evstropov, S.E. Saddow, Y. Koshka and Y. Melnik, *Photoconductivity in porous GaN layers*, Phys. Stat. Sol. B., 2001, vol. 228, no. 2, pp. 589-592.
[63] T.V. Torchynska, M. Morales Rodríguez, A. Vivas Hernandez, G. Polupan, S. Ostapenko and M. Mynbaeva, *Raman scattering investigation on porous SiC layers*, Phys. Stat. Sol. C, 2005, vol. 2, no. 8, pp. 2962-2965.
[64] T.V. Torchynska, A. Vivas Hernandez, A. Diaz Cano, S. Jiménez-Sandoval, S. Ostapenko and M. Mynbaeva, *Raman-scattering and structure investigations on porous SiC layers*, J. Appl. Phys., 2005, vol. 97, no. 3, art. 033507.
[65] T.V. Torchynska, A. Diaz Cano, S. Jiménez-Sandoval, M. Dubic, S. Ostapenko and M. Mynbaeva, *Photoluminescence and Raman spectroscopy in porous SiC*, Microelectron. J., 2005, vol. 36, no. 3-6, pp. 536-538.
[66] T.V. Torchynska, A.D. Cano, M. Dubic, S. Ostapenko and M. Mynbaeva, *Stimulation of excitonic and defect-related luminescence in porous SiC*, Physica B: Cond. Matter., 2006, vol. 376-377, pp. 367-369.
[67] M.M. Rodriguez, J.M. Rivas, A.D. Cano, T.V. Torchynska, J.P. Gomez, G.G. Gasga, S.J. Sandoval and M. Mynbaeva, *Comparative investigation of optical and structural properties of porous SiC*, Microelectron. J., 2008, vol. 39, no. 3-4, pp. 494-498.
[68] M. Mynbaeva, K. Mynbaev and D. Tsvetkov, HVPE growth of GaN on porous SiC substrates, In: Porous silicon carbide and gallium nitride: epitaxy, catalysis, and biotechnology applications, ed. by R.M. Feenstra and C.E.C. Wood (London: John Wiley and Sons, 2008), pp. 171-211.
[69] M. Mynbaeva and K. Mynbaev, *Technological applications of porous SiC*, In: *Nanocrystals and Quantum Dots of Group IV Semiconductors*, ed. by T.V. Torchynska and Yu.V. Vorobiev (Stevenson Ranch: American Scientific Publishers, 2010), pp. 253-273.
[70] H.J. Von Bardeleben, J.L. Cantin, M. Mynbaeva and S.E. Saddow, *EPR Studies of Interface Defects in n-Type 6H-SiC/SiO_2 Using Porous SiC*, Materials Science Forum, vol. 433-436, pp. 495-498 (Trans Tech Publications, Ltd.).
[71] M.G. Mynbaeva, D.A. Bauman and K.D. Mynbaev, *On the Role of Vacancies in Pore Formation in the Course of Anodizing of Silicon Carbide*, Phys. Sol. State., 2005, vol. 47, no. 9, pp. 1630–1636.
[72] M. Mynbaeva, A. Lavrent`ev, I. Kotousova, A. Volkova, K. Mynbaev and A. Lebedev, *On Current Limitations in Porous SiC Applications*, Materials Science Forum, 2005, vol. 483-485, pp. 269-272.
[73] J. Schmelzer, J. Möller, V.V. Slezov, I. Gutzow and R. Pascova, *Ostwald Ripening in Porous Materials*, Quimica Nova, 1998, vol. 21, no. 4, pp. 529-533.
[74] K. Thornton, J. Agreen and P.W. Woorhees, *Modelling the evolution of phase boundaries in solids at the meso- and nano-scales*, Acta Mater., 2003, vol. 51, no. 19, pp. 5675-5710.

[75] P. Newby, J.-M. Bluet, V. Aimez, L.G. Fréchette and V. Lysenko, *Structural properties of porous 6H silicon carbide*, Phys. Stat. Sol. C, 2011, vol. 8, no. 6, pp. 1950-1953.
[76] M.G. Mynbaeva, E.N. Mokhov, A.A Lavrent'ev and K.D. Mynbaev, *High-Temperature Diffusion Doping of Porous Silicon Carbide*, Tech. Phys. Lett., 2008, vol. 34, no. 9, pp. 731-733.
[77] N. Savkina, V. Shuman, V. Ratnikov, A. Lebedev and A. Rogachev, *Features of Sublimation Growth on Porous SiC Substrates: Characteristics and Properties of Porous and Epitaxial Layers*, Materials Science Forum, 2003, vol. 433-436, pp. 189-192 (Trans Tech Publications, Ltd.).
[78] A. Bourret, Compliant substrates: a review on the concept, techniques and mechanisms, Appl. Surf. Sci., 2000, vol. 146, no. 1-4, pp. 3-14.
[79] S. Lury and E. Suhir, *New approach to the high quality epitaxial growth of lattice-mismatched materials*, Appl. Phys. Lett., 1986, vol. 49, no. 3, pp. 140-142.
[80] D. Hersee, D. Zubia, X. Sun, R. Bommena, M. Fairchild, S. Zhang, D. Burckel, A. Frauenglass and S.R.J. Brueck, *Nanoheteroepitaxy for the integration of highly mismatched semiconductor materials*, IEEE J. Quantum Electron., 2002, vol. 38, no. 8, pp. 1017-1028.
[81] S.I. Romanov, V.I. Mashanov, L.V. Sokolov, A. Gutakovskii and O.P. Pchelyakov, *GeSi films with reduced dislocation density grown by molecular-beam epitaxy on compliant substrates based on porous silicon*, Appl. Phys. Lett., 1999, vol. 75, no. 26, pp. 4118-4118.
[82] R.S.Q. Fareed, V. Adivarahan, C.Q. Chen, S. Rai, E. Koukstis, J.W. Yang, M. Asif Khan, J. Caissie and R.J. Molnar, *Air-bridged lateral growth of crack-free $Al_{0.24}Ga_{0.76}N$ on highly relaxed porous GaN*, Appl. Phys. Lett., 2004, vol. 84, no. 5, pp. 696-698.
[83] F. Yun, M.A. Reshchikov, L. He, H. Morkoç, C.K. Inoki and T.S. Kuan, *Growth of GaN films on porous SiC substrate by molecular-beam epitaxy*, Appl. Phys. Lett., 2002, vol. 81, no. 22, pp. 4142-4144.
[84] F. Yun, S. Doğan, Y.T. Moon, Y. Fu, J. Xu, D. Johnstone and H. Morkoç, *Characterization of MOCVD grown GaN on porous SiC templates*, Phys. Stat. Sol. C, 2005, vol. 2, no. 7, pp. 2087-2090.
[85] A. Sagar, C.D. Lee, R. Feenstra, C.K. Inoki and T.S. Kuan, *Plasma-assisted molecular beam epitaxy of GaN on porous SiC substrates with varying porosity*, J. Vac. Sci. Technol. B, 2003, vol. 21, no. 4, pp. 1812-1817.
[86] C.K. Inoki, T.S. Kuan, C.D. Lee, A. Sagar, R.M. Feenstra, D.D. Koleske, D.J. Diaz, P.W. Bohn and I. Aldesida, *Growth of GaN on porous SiC and GaN substrates*, J. Electron. Mater., 2003, vol. 32, no. 8, pp. 855-860.
[87] J.K. Jeong, H.J. Kim, H.C. Seo, H.J. Kim, E. Yoon, C.S. Hwang and H.J. Kim, *Improvement in the Crystalline Quality of Epitaxial GaN Films Grown by MOCVD by Adopting Porous 4H-SiC Substrate*, Electrochem. Sol.–State Lett., 2004, vol. 7, no. 4, pp. C43-C45.
[88] H. Morkoç, Comprehensive characterization of hydride VPE grown GaN layers and templates, Mater. Sci. Eng. R., 2001, vol. 33, no. 5-6, pp. 135-207.
[89] M. Mynbaeva, A. Titkov, A. Kryzhanovski, I. Kotousova, A.S. Zubrilov, V.V. Ratnikov, V.Yu. Davydov, N.I. Kuznetsov, K. Mynbaev, D.V. Tsvetkov, S. Stepanov, A. Cherenkov and V.A. Dmitriev, *Strain relaxation in GaN layers grown on porous GaN sublayers*, MRS Internet J. Nitride Semiconductor Res., 1999, vol. 4, no. 1, art. e14.
[90] M. Mynbaeva, A. Titkov, A. Kryzhanovski, V. Ratnikov, K. Mynbaev, R.Laiho, H. Huhtinen and V.A. Dmitriev, *Structural characterization and strain relaxation in porous GaN layers*, Appl. Phys. Lett., 2000, vol. 76, no. 9, pp. 1113-115.
[91] M. Mynbaeva, A. Sitnikova, A. Tregubova and K. Mynbaev, *HVPE GaN growth on porous SiC with closed surface porosity*, J. Cryst. Growth., 2007, vol. 303, no. 2, pp. 472-479.
[92] M.G. Mynbaeva, O.V. Konstantinov, K.D. Mynbaev, A.E. Romanov and A.A. Sitnikova, *Mechanism of misfit stress relaxation during epitaxial growth of GaN on porous SiC substrates*, Tech. Phys. Lett., 2006, vol. 32, no. 12, pp. (2006) 1011-1013.
[93] .M. Mynbaeva, S.E. Saddow, G. Melnychuk, I. Nikitina, M. Scheglov, A. Sitnikova, N. Kuznetsov, K. Mynbaev and V. Dmitriev, *Chemical vapor deposition of 4H-SiC epitaxial layers on porous SiC substrates*, Appl. Phys. Lett., 2001, vol. 78, no. 1, pp. 117-119.
[94] S.E. Saddow, M. Mynbaeva, M.C.D. Smith, A.N. Smirnov and V. Dmitriev, *Growth of SiC epitaxial layers on porous surfaces of varying porosity*, Appl. Surf. Sci., 2001, vol. 184, no. 1-4, pp. 72-78.

[95] S.E. Saddow, G. Melnychuk, M. Mynbaeva, I. Nikitina, W.M. Vetter, L. Jin, M. Dudley, M. Shamsuzzoha, V. Dmitriev and C.E.C. Wood, *Structural Characterization Of Sic Epitaxial Layers Grown On Porous Sic Substrates*, Mater. Res. Soc. Symp. Proc., 2001, vol. 640, art. H.2.7.
[96] M.G. Mynbaeva, A.E. Nikolaev, A.A. Sitnikova and K.D. Mynbaev, *HVPE homo-epitaxial growth of GaN on porous substrates*, CrystEngComm, 2013, vol. 15, no. 18, pp. 3640-3646.
[97] M. Mynbaeva, A. Sitnikova, A. Nikolaev, K. Vinogradova, K. Mynbaev and V. Nikolaev, *Self-organized defect control during GaN homoepitaxial growth on nanostructured substrates*, Phys. Stat. Sol. C, 2013, vol. 10, no. 3, pp. 366-368.
[98] N.I. Kuznetsov, M.G. Mynbaeva, G. Melnychuk, V.A. Dmitriev and S.E. Saddow, *Electrical characterization of Schottky diodes fabricated on SiC epitaxial layers grown on porous SiC substrate*s, Appl. Surf. Sci., 2001, vol. 184, no. 1, pp. 483-486.
[99] A. Syrkin, V. Dmitriev, V. Soukhoveev, M. Mynbaeva, R. Kakanakov, C. Hallin and E. Janzen, *4H-SiC Power Schottky Diodes. On the Way to Solve the Size Limiting Issues*, Materials Science Forum, 2004, vol. 457-460, pp. 985-988 (Trans Tech Publications, Ltd.).
[100] T.S. Argunova, M.Yu. Gutkin, J.H. Je, L.M. Sorokin, G.N. Mosina, N.S. Savkina, V.B. Shuman and A.A. Lebedev, *X-Ray Imaging and TEM Study of Micropipes Related to their Propagation through Porous SiC Layer/SiC Epilayer Interface*, Materials Science Forum, 2004, vol. 457-460, pp. 363-366 (Trans Tech Publications, Ltd.).
[101] M.Yu. Gutkin, A.G. Sheinerman and M.A. Smirnov, *Elastic behavior of screw dislocations in porous solids*, Mech. Mater., 2009, vol. 41, no. 8, pp. 905-918.
[102] D.M. Artemiev, T.S. Orlova, V.E. Bougrov, M.A. Odnoblyudov and A.E. Romanov, *Reaction-kinetics model for threading dislocation density reduction in GaN porous layer*, AIP Conf. Proceedings, 2014, vol. 1583, pp. 310-314.
[103] D.M. Artemiev, T.S. Orlova, V.E. E. Bougrov, M.A. Odnoblyudov and A.E. Romanov, *Modeling of Threading Dislocation Density Reduction in Porous III-Nitride Layers*, J. Electron. Mater., 2015, vol. 44, no. 5, pp. 1287-1292.
[104] M.Yu. Gutkin and E.A. Rzhavtsev, *Dynamics of threading dislocations in porous heteroepitaxial GaN films*, Phys. Sol. State, 2017, vol. 59, no. 12, pp. 2394-2400.
[105] M.G. Mynbaeva, A.A. Lavrent'ev, N.I. Kuznetsov, A.N. Kuznetsov, K.D. Mynbaev and A.A. Lebedev, *Semi-Insulating Silicon Carbide Layers Obtained by Diffusion of Vanadium into Porous 4H-SiC*, Semiconductors, 2003, vol. 37, no. 5, pp. 594-597.
[106] M.G. Mynbaeva, E.L. Pankratov, E.N. Mokhov and K.D. Mynbaev, *Analysis of erbium and vanadium diffusion in porous silicon carbide*, Adv. Cond. Matter Phys., 2012, vol. 2012, art. 439617.
[107] M.G. Mynbaeva, A.A. Lavrent'ev, A.V. Fomin, K.D. Mynbaev and A.A. Lebedev, *Magnesium Outdiffusion from Porous Silicon Carbide Substrates during Autodoping of Gallium Nitride Epilayers*, Tech. Phys. Lett., 2003, vol. 29, no. 3, pp. 474-476.
[108] E.L. Pankratov, M.G. Mynbaeva, K.D. Mynbaev and E.N. Mokhov, *Diffusion in Porous Silicon Carbide, Phys. Sol. State*, 2011, vol. 53, no. 5, pp. 943-949.
[109] S.I. Soloviev and T.S. Sudarshan, Processing Porous SiC: Diffusion, Oxidation, Contact Formation, In: Porous Silicon Carbide and Gallium Nitride: Epitaxy, Catalysis, and Biotechnology Applications, ed. by R.M. Feenstra and C.E.C. Wood (London: John Wiley and Sons, 2008), pp. 31-54.
[110] Y. Koshka, Y. Song, J. Walker, S.E. Saddow and M. Mynbaeva, *Spin-On Doping of Porous SiC with Er*, Materials Science Forum, 2004, vol. 457-460, pp. 763-766 (Trans Tech Publications, Ltd.).
[111] M.G. Mynbaeva, A.A. Sitnikova, D.A. Kirilenko and I.S. Kotousova, *Graphene/silicon carbide-based scaffolds*, J. Phys. D: Appl. Phys., 2012, vol. 45, no. 33, art. 335303.
[112] Silicon Carbide Biotechnology. A Biocompatible Semiconductor for Advanced Biomedical Devices and Applications, ed. by S.E. Saddow, (Elsevier, 1st Edition 2011).

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