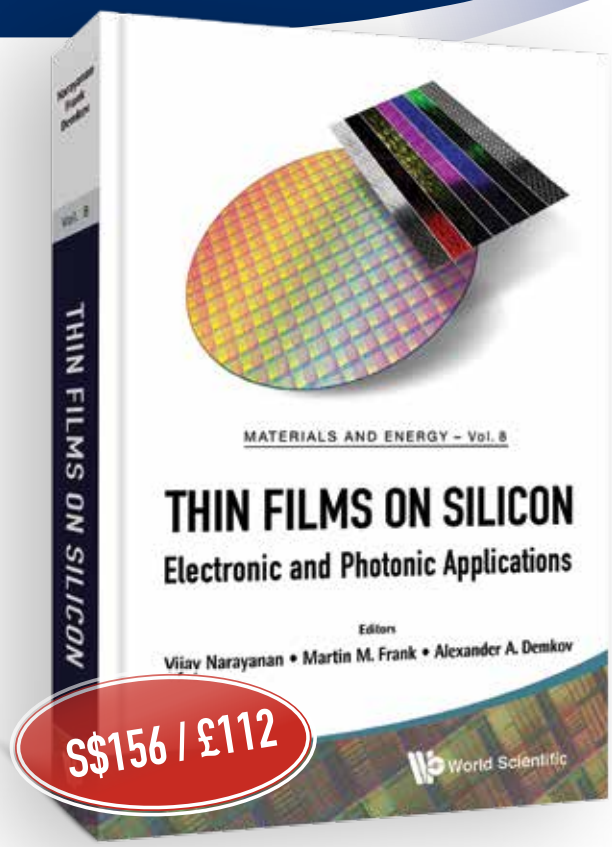

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Graduate students and researchers in the fields of materials science, applied physics, and electrical engineering

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THIN FILMS ON SILICON

Electronic and Photonic Applications

edited by

Vijay Narayanan, Martin M Frank
IBM Thomas J. Watson Research Center, USA
& Alexander A Demkov
The University of Texas at Austin, USA

This volume provides a broad overview of the fundamental materials science of thin films that use silicon as an active substrate or passive template, with an emphasis on opportunities and challenges for practical applications in electronics and photonics. It covers three materials classes on silicon: Semiconductors such as undoped and doped Si and SiGe, SiC,GaN, and III-V arsenides and phosphides; dielectrics including siliconnitride and high-k, low-k, and electro-optically active oxides; and metals,in particular silicide alloys. The impact of film growth and integration on physical, electrical, and optical properties, and ultimately device performance, is highlighted.

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About the Editors

Vijay Narayanan

Dr. Narayanan received his B.Tech. in Metallurgical Engineering from the Indian Institute of Technology, Madras (1995), and his M.S. (1996) and Ph.D. (1999) in Materials Science and Engineering from Carnegie Mellon University where his dissertation concentrated on understanding the origins of line and planar defects during the epitaxial growth of Gallium Phosphide on different orientations of Si. Currently, Dr. Narayanan is a Manager and Distinguished Research Staff Member within the IBM T. J. Watson Research Center where his research interests range from High-κ/Metal Gate materials for CMOS Logic to Ferroelectric field effect transistors for low voltage applications. He is an author or co-author of over 100 journal and conference papers and holds 75 US patents.

Dr. Narayanan was awarded an IBM Research Division Award for contributions to High-κ/Metal Gates in 2006 and was recognized as an IBM Master Inventor in 2007. He is an IEEE Senior Member and was elected a fellow of the American Physical Society in 2011. In addition, in recognition of his contributions to high-κ/metal gate technology, Dr. Narayanan received an IBM Corporate Award in 2013.

Martin Frank

Dr. Martin M. Frank is a Research Staff Member at IBM T. J. Watson Research Center in Yorktown Heights, NY. His research focuses on new materials for CMOS transistor scaling, including high-permittivity (high-k) gate dielectrics, metal gate electrodes, high-carrier-mobility materials such as Ge and InGaAs, and ferroelectrics. In 1996, Dr. Frank earned a Diplom degree in physics from Ruhr-Universität Bochum, Germany. He then joined Fritz-Haber-Institut der Max-Planck-Gesellschaft in Berlin, Germany, studying the catalytic activity of oxide-supported metal nanoparticles using surface science techniques in ultra-high vacuum. In 2000, Dr. Frank received a Ph.D. degree in physics from Humboldt-Universität zu Berlin, and was awarded the Otto Hahn Medal for outstanding scientific achievements. In 2003, Dr. Frank joined IBM. During an assignment to IMEC in Leuven, Belgium, he worked in the field of photoresist chemistry. In 2007, he was recognized as an IBM Master Inventor. In 2013, he received an IBM Research Division Award for his contributions to high-k/metal gate technology.

Dr. Frank has authored or co-authored more than 100 publications including multiple review articles and book chapters, has given more than 60 invited and contributed presentations, and holds more than 50 U.S. patents.

Alexander A Demkov

Prof. Demkov is a professor of Physics at The University of Texas at Austin. He received his Ph.D. in theoretical physics in 1995 from Arizona State University (ASU). In 1995-1997, he was a postdoctoral researcher at ASU. In 1997-2005, he was a principal staff scientist in Motorola.s R&D organization providing theoretical support for the development of low- and high-k dielectric materials. In 2005, he joined the faculty of the Physics Department at the University of Texas at Austin.

Prof. Demkov has published over 100 research papers and has been awarded seven U.S. patents. He has contributed to several books and edited one, entitled "Materials Fundamentals of Gate Dielectrics," and has also co-authored the 2005 edition of the International Technology Roadmap for Semiconductors (ITRS). In 2002-2004, he served as Associate Editor of the Journal of Vacuum Science and Technology B. He also served as Guest Editor for several issues of physica status solidi (b). Demkov received the NSF CAREER award, 2011 IBM Faculty Award, and is a Fellow of the American Physical Society.

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