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DR. ING . NICOLE HERBOTS, I.R. UCL' 81, PHD UCL'84
SiO2 INNOVATES, Inc. 2016. *Founder, Owner CEO*
SiO2 NanoTech LLC, Inc. 2013, *co-Founder, co-Owner, CSO*
SiO2 Associates, Inc. 2009, Founder, Owner
Professor Emerita, Physics, Arizona State University

Summary

Dr. Herbots's team synthesize surfaces, materials, thin films, coatings, "interphases" and nano-phases via far-from-equilibrium nucleation and growth at temperatures, for optical, electronic and medical devices & sensors

Synthesis methods include CIMD (**Int. & US Patent 4,800,200**, *Herbots et al.*) which combines molecular adsorption, ionized species and ion induced deposition, IBO (Ion Beam Oxidation, **Int. & US pat. 5,124,421**, *Herbots et al.*), the Herbots-Atluri process (**Patents # 6,613,677; 7, 851,361**,) and NanoBonding™ (**US Patent 9018077**)

Materials include Si, SiGe, SiGeC, GaAs, (SiOCH₃)_n silicone resin, oxide phases such as SiGeO₂, SiGeC oxides, GaAs oxides, NanoBonding™ interphases , low temperature surface processing and chemical processing in class 10-10,000/ISO3-8

Characterization methods includes Ion Beam Analysis high resolution Electron Microscopy Tapping Mode Atomic Force Microscopy non-destructive light interferometry, UV and IR spectroscopy, & 3 Liquid Sessile Drop Contact Angle (3 - LCAA) to quantify surface energy, structure, hydro-affinity, pepto- and lipo-affinity. Recent innovations include semiconductor and bio-polymer nano-phases such as sub-nanometer ordered silicon dioxides (**Int & US Patent 6,613,677**, *Herbots et al.*), heteroepitaxial oxides (**US Patent 7,851,365**, *Herbots et al*), new bio-compatible emulsion coatings for human devices implants controlling condensation (VitreOx™), scarring (ProteinKnox™) and blood contamination (HemoClear™).

Dr. Herbots initiated in 2004 SiO2 Associates, with graduate students, & colleagues in academia & industry. In 2010, she founded SiO2 NanoTech. In 2013, she re- incorporated SiO2 NanoTech with C. Watson. In 2016, following a breakthrough in microliter blood analysis using IBA, HemaDrop™ , she founded SiO2 Innovates LLC.

Dr. Herbots focus on green manufacturing technology and its transfer from "Lab to Fab" in applications that require hermetic bonding for sensors (NanoBonding™), solar panels or electronics (EpOxides™, Nano-Oxides™), bio-medical applications - VitreOx™ for inhibiting fogging on laparoscopic lenses, medical implant surfaces, and other non-medical optical lenses and goggles. ProteinKnox™ was devised to control the effect of absorption of blood, blood proteins and tissue build-up on lenses and medical implants. Another of our technologies, FogKnox™ is a permanent, molecular-based control of fogging on vision-wear surfaces, where compatibility with eye tissues is important, such as protective and high performance sport eyewear where fumes and bodily fluids can create an irritating environment for the wearer.

EDUCATION

Université Catholique de Louvain

- 1981 – 1984 PhD in [Applied Physics](#) in the Sciences of Microelectronics
Advisor: Prof. F. van De Wiele (†), Microelectronics Lab (FAI), WINFAB
PhD Thesis Title: THE ROLE OF IMPURITY SEGREGATION AND SURFACE PREPARATION IN ALUMINUM-SILICON INTERDIFFUSION (*Maxima Cum Laude*)
PhD Thesis Funding: Awarded three consecutive IRSIA Doctoral Research Fellowship 1981-1984 IRSIA stands for "Institut pour l'Encouragement de la Recherche dans l'Industrie et l'Agriculture" for PhD research proposal
- 1976 – 1981 B. Sc., i.r, [Engineering in Applied Physics](#) 1976 – 1981
Faculty of Applied Science (FSA), Louvain-La-Neuve, Eng. in Applied Physics,
Undergraduate Thesis Title: DESIGN AND INSTALLATION OF A RUTHERFORD BACKSCATTERING SPECTROMETRY APPARATUS AND APPLICATION TO SEMICONDUCTOR CHARACTERIZATION, *Magna Cum Laude*.

PROFESSIONAL EXPERIENCE

- July 2016 – present* **Founder, Owner, CEO**
Prototyping, Commercialization of Innovation, Manufacturing, Phoenix, USA
"From Lab to Fab" is the motto of SiO₂, prototyping for end users, for products as VitreOx™, FogKnox™, AVNE™, NanoBonding™ for Medical Electronics, Surgical Lenses, and endoscopes
- Mar 2010 – present* **Co Founder, Chief Science Officer**
SiO₂ NanoTech LLC, R&D, Inc. 2013 with Clarizza Watson, Prototyping, Commercialization of Innovation, Manufacturing, Phoenix, USA
- Aug 1991 – present* **Prof. of Physics, Emerita**
Arizona State University, Department of Physics
Phoenix, United States

Leads her R&D teams to develop green technology solutions using semiconductor & bio-compatible nano-phases. Focus on thin film synthesis & surface affinity modifications at ASU while at SiO₂ NanoTech her focus is prototyping for end users.
- Jan 1987 – Aug 1991* **IBM Prof. of Electronic Materials**
Massachusetts Institute of Technology, Department of Materials Science and Engineering
Cambridge, United States

Teaching: Electronic Materials & Devices, Semiconductor Processing
Research: Combined Ion Molecular Deposition (CIMD), artificially structured

materials, modeling & growth of metastable oxides on GaAs SiGe.

Sep 1984 – Jan 1987 **Visiting Scientist, Researcher in the Solid State Division**

Oak Ridge National Laboratory, Solid State Division
Oak Ridge, United States

Design and construction of an Ion Beam Deposition UHV system, theoretical and computer modeling of IBD, experimental demonstration of IBD epitaxy, isotopic superlattice

Sep 1981 – Sep 1984 **Graduate Student In Applied Physics, in the Science of Microelectronics**

Catholic University of Louvain, Department of Electrical Engineering
Louvain-la-Neuve, Belgium

Class 10 clean-room processing, deposition (CVD, e-beam), Ion Beam Analysis, electrical characterization, electron microscopy & spectroscopy. Visiting Graduate Fellow, Salford U., UK, FOM-Instituut, NL, CNS-CNET of Grenoble

Business Awards & Scientific Grants

Feb 2016 SiO₂ NanoTech Innovation selected for Materials Research Society iMatSci, with CEO Clarizza Watson

Jan 2015 Flinn Foundation Bioscience Entrepreneurship for SiO₂ NanoTech, with Clarizza Watson - \$30k

Sep 2014 Elected Member-At-Large of the American Physical Society - Four Corners Section

Aug 2014 Arizona Commerce Authority (ACA) for Small Scale Manufacturing - \$20k

Nov 2013 ASU College for Liberal Arts and Science - Seed Grant for NanoBonding™ & VitreOx™ Innovation for pilot data (\$50k)

Nov 2013 TIE Pitch Award for SiO₂ NanoTech LLC, by CEO C.F. Watson, ChE, MBA - \$1k

Jun 2013 Edson Student Entrepreneurship Competition for SiO₂ NanoTech - \$20k

Oct 2012 AZ Furnace Accelerator Award for SiO₂ NanoTech LLC - \$25 k

Jun 2007 AZ ARBOR Strategic Initiative Equipment Award for US Patent 6,613,677 commercialization - EpOxNox Hood - \$30k

Dec 2005 Intel Corp License for US Patent 6,613,677 on Ordered Silicon Oxides - \$250k

Apr 1997 ASU Physics Faculty Teaching Award

NSF Materials Science Division STC- \$1,000,000 (with other co-PI)

Apr 1997 Intel Corporation Faculty Award - \$90k

Mar 1997 Research Corporation Faculty Award for Ordered Oxides - \$50k

Jul 1994 SEMATCH -Study of Si(100) hydride termination for low T epitaxy - \$125k

NSF Education Division - \$500 k (with J.W. Mayer)

Jan 1994 Eureka Fund Award (Motorola) - \$25k

ARPA SiGeC \$1, 500,000 (with J.W. Mayer)

- Mar 1992 Nominated for the Maria Goppert Award
Goldwater Professorship – Research funds - \$400,000
- Feb 1990 Petroleum Research Fund Faculty Award \$40k
- Jan 1990 Carl Soderbergh Professorship for Complex Engineering System - Research funds \$70k
- Dec 1987 AT&T Junior faculty Award - \$50k
- Sep 1986 IBM Chair Professorship in Electronic Materials, Massachusetts Institute of Technology (MIT) - \$2,000,000 with \$600,000 start-up funds
- Sep 1986 Martin Marietta Significant Event Award at Oak Ridge National Lab, DoE
- Sep 1981 SCHOLARSHIP: THREE 3-YEAR I.R.S.I.A. DOCTORAL SCHOLARSHIP (\$100k)
- Languages FLUENT - Dutch, English, Flemish, French, READS German, Hebrew, Latin, Spanish
- Scientific Memberships Materials Research Society, American Vacuum Society, American Physical Society, American Association for the Advancement of Science, IEEE

Publication Highlights

- N. Herbots, Qian Xing, M. Hart, J.D. Bradley, D.A. Sell, R.J. Culbertson, Barry J. Wilkens: *IBMM of OH adsorbates and interphases on Si-based materials*. Nuclear Instruments and Methods in Physics Research Section B Beam Interactions with Materials and Atoms 02/2012; 272:330–333. DOI:10.1016/j.nimb.2011.01.094
- K. T. Queeney, N. Herbots, Justin M. Shaw, V. Atluri, YJ Chabal: *Infrared spectroscopic analysis of an ordered Si/SiO₂ interface*. Applied Physics Letters 01/2004; 84(4):493-495. DOI:10.1063/1.1644030
- O. Vancauwenberghe, N. Herbots, H. Manoharan, M. Ahrens: *Ion beam oxidation of GaAs: The role of ion energy*. Journal of Vacuum Science & Technology A Vacuum Surfaces and Films 06/1991; 9(3-9):1035 - 1039. DOI:10.1116/1.577572
- O. Vancauwenberghe, O. C. Hellman, N. Herbots, W. J. Tan: *New SiGe dielectrics grown at room temperature by low energy ion beam oxidation and nitridation*. Applied Physics Letters 11/1991; 59(16-59):2031 - 2033. DOI:10.1063/1.106122
- N Herbots, J.M Shaw, Q.B Hurst, M.P Grams, R.J Culbertson, David J Smith, V Atluri, P Zimmerman, K.T Queeney: *The formation of ordered, ultrathin SiO₂/Si(100) interfaces grown on (1×1) Si(100)*. Materials Science and Engineering B 12/2001; 87(3):303-316. DOI:10.1016/S0921-5107(01)00729-2

Journal Publications

- Ross Bennett-Kennett, Nicole Herbots, Ashlee Murphy, David Sell, Tyler Kutz, Sophia Benitez, Ajija Acharya, Brett Hughes, Clarizza Watson, Eric Culbertson, Clive Sell, H. Kwong: *Modeling Condensation, Hydro- and Pepto-affinity of Surfaces in Medical Implant Devices and Surgical Lenses: Effect of Blood Proteins*.
- Ross Bennett-Kennett, Shawn Whaley, Nicole Herbots, Clarizza Watson, Robert Culbertson, Peter Rez, Ashlee Murphy, Sam Farmer, David Sell, Brett Hughes, Ajju Acharya: *Wet Nano-Bonding of Silica-to-*

Si and Silica-to-Silica below 200°C by H₂O catalysis and a 2-D precursor phase: TMAFM, Hydroaffinity and Surface Free Energy Analysis.

- N. Herbots, Qian Xing, M. Hart, J.D. Bradley, D.A. Sell, R.J. Culbertson, Barry J. Wilkens: *IBMM of OH adsorbates and interphases on Si-based materials*. Nuclear Instruments and Methods in Physics Research Section B Beam Interactions with Materials and Atoms 02/2012; 272:330–333. DOI:10.1016/j.nimb.2011.01.094
- Qian Xing, N. Herbots, M. Hart, J. D. Bradley, B. J. Wilkens, D. A. Sell, Clive H. Sell, Henry Mark Kwong, R. J. Culbertson, S. D. Whaley: *Ion Beam Analysis Of Silicon-Based Surfaces And Correlation With Surface Energy Measurements*. 06/2011; 1336. DOI:10.1063/1.3586089
- Qian Xing, M. A. Hart, R. J. Culbertson, J. D. Bradley, N. Herbots, Barry J. Wilkens, David A. Sell, Clarizza Fiel Watson: *Particle-Induced X-Ray Emission (PIXE) Of Silicate Coatings On High Impact Resistance Polycarbonates*. 06/2011; 1336. DOI:10.1063/1.3586109
- N. Herbots, B.R. Appleton, S.J. Pennycook, T.S. Noggle, R.A. Zuhr: *Ion Beam Deposition of Materials At 40–200 Ev: Effect of Ion Energy And Substrate Temperature On Interface, Thin Film And Damage Formation*. MRS Online Proceeding Library 01/2011; 51. DOI:10.1557/PROC-51-369
- Nicole Herbots, D. Gloesener, E. J. Van Loenen, A. E. M. J. Fischer: *Surface Characterization of Arsenic Implanted Silicon (100): A New Insight into the Inhibition of Aluminum/Silicon Interdiffusion*. MRS Online Proceeding Library 01/2011; 37. DOI:10.1557/PROC-37-613
- Murdock Hart, Shawn Whaley, James Bradley, David Sell, Nicole Herbots, Robert Culbertson, Vasudeva Atluri: *Low Temperature Bonding of Si to Silicates using Langmuir-Blodgett molecular films as precursors for a bonding SiO_xSi interphase*.
- Justin M. Shaw, N. Herbots, Q. B. Hurst, D. Bradley, R. J. Culbertson, V. Atluri, K. T. Queeney: *Atomic displacement free interfaces and atomic registry in SiO₂/(1×1) Si(100)*. Journal of Applied Physics 11/2006; 100(10):104109-104109-4. DOI:10.1063/1.2358835
- K. T. Queeney, N. Herbots, Justin M. Shaw, V. Atluri, YJ Chabal: *Infrared spectroscopic analysis of an ordered Si/SiO₂ interface*. Applied Physics Letters 01/2004; 84(4):493-495. DOI:10.1063/1.1644030
- J. Bradley, N. Herbots, J. Shaw, V. Atluri, K. T. Queeney, Y. J. Chabal: *A New Ordered Si/SiO₂ phase: Infrared Spectroscopy Analysis and Modeling*.
- N Herbots, J.M Shaw, Q.B Hurst, M.P Grams, R.J Culbertson, David J Smith, V Atluri, P Zimmerman, K.T Queeney: *The formation of ordered, ultrathin SiO₂/Si(100) interfaces grown on (1×1) Si(100)*. Materials Science and Engineering B 12/2001; 87(3):303-316. DOI:10.1016/S0921-5107(01)00729-2
- Nicole Herbots: *FOR A RESEARCH OPPORTUNITY AWARDEE: TRAGEDY AND A COMEBACK*.
- V. Atluri, N. Herbots: *H-passivation of Si(100) By Wet Chemical Cleaning: Discovery of Ordering*. MRS Online Proceeding Library 12/1997; 513. DOI:10.1557/PROC-513-399
- Harald Jacobsson, Joan Xiang, Nicole Herbots, Shawn Whaley, Peihua Ye, Sean Hearne: *Heteroepitaxial properties of Si_{1-x-y}GexCy on Si(100) grown by combined ion- and molecular-beam deposition*. Journal of Applied Physics 03/1997; 81(7):3081-3091. DOI:10.1063/1.364352
- V. Atluri, N. Herbots, D. Dagele, S. Bhagvat, S. Whaley: *Hydrogen passivation of Si(100) wafers as templates for low temperature (T < 600°C) epitaxy*. Nuclear Instruments and Methods in Physics Research Section B Beam Interactions with Materials and Atoms 09/1996; 118(s 1–4):144–150. DOI:10.1016/0168-583X(95)01490-X
- S. Hearne, N. Herbots, J. Xiang, P. Ye, H. Jacobsson: *Characterization of carbon in heteroepitaxial Si_{1-x-y}GexCy thin films via combined ion channeling and nuclear resonance analysis*. Nuclear Instruments and

Methods in Physics Research Section B Beam Interactions with Materials and Atoms 09/1996; 118(1-118):88-96. DOI:10.1016/0168-583X(95)01486-1

Harald Jacobsson, Peihua Ye, Nicole Herbots, Sean Hearne, Joan Xiang: *Microstructure and ion beam characterization of heteroepitaxial Si_{1-x-y}GexCy*. Nuclear Instruments and Methods in Physics Research Section B Beam Interactions with Materials and Atoms 09/1996; 118(1-4):633-639. DOI:10.1016/0168-583X(95)01463-2

J. Xiang, N. Herbots, H. Jacobsson, P. Ye, S. Hearne, S. Whaley: *Comparative study on dry oxidation of heteroepitaxial Si_{1-x}Gex and Si_{1-x-y}GexCy on Si(100)+*. Journal of Applied Physics 09/1996; 80(3-80):1857 - 1866. DOI:10.1063/1.362998

Nicole Herbots, Peihua Ye, Harald Jacobsson, Joan Xiang, Sean Hearne, Nigel Cave: *The onset of secondary phase precipitation during synthesis of heteroepitaxial Si_{1-x-y}GexCy on Si(100)*. Applied Physics Letters 02/1996; 68(6):782-784. DOI:10.1063/1.116531

C PONTHEIU, C MARHIC, M LANCIN, N HERBOTS: *SIMS, EDX, EELS, AES, XPS STUDY OF INTERPHASES IN NICALON FIBER LAS GLASS MATRIX COMPOSITES .2. CHEMISTRY OF THE INTERPHASES (VOL 29, PG 4535, 1994)*. Journal of Materials Science 11/1994; 29(22):U1-U1.

Y. Levin, N. Herbots, S. Dunham: *Damage-to-dose ratio after low energy silicon ion implantation into crystalline silicon*. 09/1993; 8(9):2305-2309. DOI:10.1557/JMR.1993.2305

N. Herbots: *Thin film formation from low energy ions: new kinetic paths, new properties, new phases*. Materials and Design 12/1992; 13(2):95-95. DOI:10.1016/0261-3069(92)90116-Y

Olof C. Hellman, Nicole Herbots, Olivier Vancauwenberghe, R. J. Culbertson, W. J. Croft: *Microstructure and stoichiometry dependence of ion beam nitrides as a function of energy and temperature: A comparative study between Si and SiGe*. Journal of Vacuum Science & Technology A Vacuum Surfaces and Films 08/1992; 10(4-10):1631 - 1636. DOI:10.1116/1.577761

O. Vancauwenberghe, N. Herbots, O. C. Hellman: *Role of ion energy in ion beam oxidation of semiconductors: Experimental study and model*. Journal of Vacuum Science & Technology A Vacuum Surfaces and Films 08/1992; 10(4-10):713 - 718. DOI:10.1116/1.577715

O. C. Hellman, N. Herbots, O. Vancauwenberghe: *Kinetics of ion beam nitridation (IBN) of Si and of MBE-grown Ge and SixGe_{1-x} alloys: The role of ion energy, ion dose and substrate temperature*. Nuclear Instruments and Methods in Physics Research Section B Beam Interactions with Materials and Atoms 04/1992; 67(1-4):301-307. DOI:10.1016/0168-583X(92)95821-8

O.C. Hellman, O. Vancauwenberghe, N. Herbots, J. Olson, R.J. Culbertson, W.J. Croft: *Structure and properties of silicon nitride and SixGe_{1-x} nitride prepared by direct low energy ion beam nitridation*. Materials Science and Engineering B 01/1992; 12(1-2-12):53-59. DOI:10.1016/0921-5107(92)90258-B

O. Vancauwenberghe, O. C. Hellman, N. Herbots, W. J. Tan: *New SiGe dielectrics grown at room temperature by low energy ion beam oxidation and nitridation*. Applied Physics Letters 11/1991; 59(16-59):2031 - 2033. DOI:10.1063/1.106122

S. Motakef, J. M. E. Harper, F. M. dHeurle, T. A. Gallo, N. Herbots: *Stability of C49 and C54 phases of TiSi₂ under ion bombardment*. Journal of Applied Physics 10/1991; 70(5-70):2660 - 2666. DOI:10.1063/1.349380

O. Vancauwenberghe, N. Herbots, O. C. Hellman: *A quantitative model of point defect diffusivity and recombination in ion beam deposition and combined ion and molecular deposition*. Journal of vacuum science & technology. B, Microelectronics and nanometer structures: processing, measurement, and phenomena: an official journal of the American Vacuum Society 08/1991; 9(4-9):2027 - 2033. DOI:10.1116/1.585771

- N HERBERTS, O VANCAUWENBERGHE, O.C. Hellman, Y.C. Joo: *Atomic collisions, elastic recombination, and thermal diffusion during thin-film growth from low-energy ion beams*. Nuclear Instruments and Methods in Physics Research Section B Beam Interactions with Materials and Atoms 07/1991; 59-60:326-331. DOI:10.1016/0168-583X(91)95233-4
- O. Vancauwenberghe, N. Herbots, H. Manoharan, M. Ahrens: *Ion beam oxidation of GaAs: The role of ion energy*. Journal of Vacuum Science & Technology A Vacuum Surfaces and Films 06/1991; 9(3-9):1035 - 1039. DOI:10.1116/1.577572
- Nicole Herbots, O.C. Hellman, O. Vancauwenberghe: *Epitaxy and Chemical Reactions During Thin Film Formation from Low Energy Ions New Kinetic Pathways, New Phases and New Properties*. MRS Online Proceeding Library 12/1990; 236. DOI:10.1557/PROC-236-287
- Olivier Vancauwenberghe, Nicole Herbots, Olof C. Hellman: *Role of point defect diffusion and recombination in low-temperature growth of semiconductor heterostructures using low-energy ion beams*. Proceedings of SPIE - The International Society for Optical Engineering 10/1990; DOI:10.1117/12.20805
- Patricia Ann. Cullen, Ph.D. *Enhancement of initial stages of silicon oxidation with implanted dopants*, MASSACHUSETTS INSTITUTE OF TECHNOLOGY Thesis (1991) Advisor: Nicole Herbots
- Leonard Rubin, David Hoffman, D. Hoffman Di Ma, Nicole Herbots: *Shallow-junction diode formation by implantation of arsenic and boron through titanium-silicide films and rapid thermal annealing*. IEEE Transactions on Electron Devices 02/1990; 37(1-37):183 - 190. DOI:10.1109/16.43815
- David C. Eng, Nicole Herbots, Olof C. Hellman, Olivier Vancauwenberghe, Shahrnaz Motakef, Robert J. Culbertson: *The role of interfacial segregation and microstructure in interdiffusion between aluminum and silicon*. Journal of Electronic Materials 10/1989; 18(6):689-693. DOI:10.1007/BF02657520
- R. A. Zuhr, S. J. Pennycook, T. S. Noggle, N. Herbots, T. E. Haynes, B. R. Appleton: *Ion beam deposition in materials research*. Nuclear Instruments and Methods in Physics Research Section B Beam Interactions with Materials and Atoms 02/1989; 37:16-21. DOI:10.1016/0168-583X(89)90129-8
- N. Herbots, O. C. Hellman: *Combined ion and molecular beam apparatus and method for depositing materials: US Patent 4,800,100*. Journal of the Patent Office Society. Patent Office Society (U.S.) 01/1989;
- Olof C. Hellman, Nicole Herbots, David C. Eng: *A Model for Interdiffusion at Metal Semiconductor Interfaces: Conditions for Spiking*. MRS Online Proceeding Library 12/1988; 148. DOI:10.1557/PROC-148-83
- Leonard Rubin, Nicole Herbots, JoAnne Gutierrez, David Hoffman, Di Ma: *Integrated Processing of Silicided Shallow Junctions using Rapid Thermal Annealing Prior to Dopant Activation*. MRS Online Proceeding Library 12/1988; 146. DOI:10.1557/PROC-146-191
- N. Herbots, O. C. Hellman, P. A. Cullen, O. Vancauwenberghe: *Semiconductor-based heterostructure formation using low energy ion beams: Ion beam deposition (IBD) & combined ion and molecular beam deposition (CIMD)*. 09/1988; 167(1):259-290. DOI:10.1063/1.37156
- R. A. Zuhr, B. R. Appleton, N. Herbots, B. C. Larson, T. S. Noggle, S. J. Pennycook: *Low-temperature epitaxy of Si and Ge by direct ion beam deposition*. Journal of Vacuum Science & Technology A Vacuum Surfaces and Films 08/1987; 5(4-5):2135 - 2139. DOI:10.1116/1.574935
- B. R. Appleton, S. J. Pennycook, R. A. Zuhr, N. Herbots, T. S. Noggle: *Low-temperature epitaxial growth of Si and Ge and fabrication of isotopic heterostructures by direct Ion Beam Deposition (IBD)*. Nuclear Instruments and Methods in Physics Research Section B Beam Interactions with Materials and Atoms 02/1987; 19-20. DOI:10.1016/S0168-583X(87)80195-7
- R. Vanden Berghe, R. Vlaeminck, M. Van Craen, N. Herbots, D. Gloesener, F. Van de Wiele, G. De Doncker, J. Vennik, H. Tollet, C. Creemers, A. Neyens, J. Van Vooren: *A comparison of AES, SIMS,*

ISS and RBS analysis of Si x N y layers. Fresenius Zeitschrift für Analytische Chemie 01/1987; 329(2):380-384. DOI:10.1007/BF00469176

- R. A. Zuhr, G. D. Alton, B. R. Appleton, N. Herbots, T. S. Noggle, S. J. Pennycook: *Direct Formation of Thin Films and Epitaxial Overlayers at low Temperatures Using a Low-Energy (10–;500 eV) Ion Beam Deposition System.* MRS Online Proceeding Library 01/1987; 93. DOI:10.1557/PROC-93-243
- N. Herbots, B. R. Appleton, T. S. Noggle, R. A. Zuhr, S. J. Pennycook: *Ion-solid interactions during ion beam deposition of ⁷⁴Ge and ³⁰Si on Si at very low ion energies (0-200 eV range).* Nuclear Instruments and Methods in Physics Research Section B Beam Interactions with Materials and Atoms 03/1986; 13(1-3):250-258. DOI:10.1016/0168-583X(86)90512-4
- N. Herbots, B. R. Appleton, T. S. Noggle, S. J. Pennycook, R. A. Zuhr, D. M. Zehner: *Epitaxial growth and heterostructure synthesis by Ion Beam Deposition (IBD).*
- B. R. Appleton, R. A. Zuhr, T. S. Noggle, N. Herbots, S. J. Pennycook: *Investigations of low-temperature epitaxy, ion damage, and reactive-ion cleaning utilizing ion beam deposition.*
- Nicole Herbots, Maurice Lobet, Fernand Van de Wiele: *RBS study of the effect of arsenic and phosphorus interfacial segregation upon the sintering of contacts between implanted polycrystalline silicon and aluminum: Silicon(1%).* Nuclear Instruments and Methods in Physics Research Section B Beam Interactions with Materials and Atoms 03/1985; s 7–8(MAR):278–286. DOI:10.1016/0168-583X(85)90566-X
- N. Herbots, D. Gloesener, E.J. van Loenen, A.E.M.J. Fischer: *Surface characterization of As implanted Si(100): a new insight in the inhibition of Al/Si interdiffusion.* Materials Research Society symposia proceedings. Materials Research Society 01/1985; 37:613.
- M. Liehr, J. P. Delrue, R. Caudano, N. Herbots, R. A. L. vanden Berghe, R. Vlaeminck, H. Loos: *Comparative study of Nb and TiW barrier layers between Au and a-SiO₂.* Journal of Vacuum Science & Technology A Vacuum Surfaces and Films 04/1984; 2(2):288-291. DOI:10.1116/1.572583
- Nicole Herbots: *Arsenic Dopant Influence upon the Sintering Behavior of the Aluminum-Polysilicon Interface.* Journal of The Electrochemical Society 01/1984; 131(3). DOI:10.1149/1.2115650
- N. Herbots, F. Vandewiele, M. Lobet, R. G. Elliman: *Arsenic Dopant Influence Upon the Sintering Behavior of the Aluminum-Polysilicon Interface.* Journal of The Electrochemical Society 01/1984; 131(3):645-652.
- M. Nastasi, L. R. Harriott, N. Herbots, R. S. Averback: *Beam solid interactions: Fundamentals and applications.*

Patents

- Nicole Herbots, Clarizza Watson, Eric J. Culbertson, Gabriel P.K. Watson, Pierre R. Thilmann, Abijith Krishnan, Igor Pinheiro de Oliveira Martins, Yash Pershad, Nehal Gupta, Alex Brimhall, Ashley Mascareno, Makoyi Watson: *Superhydrophilic And Hydrophilic Bio-Compatible And Bio-Safe Materials, Including Fluids and Coatings, And Their Applications For Anti-Fog Control On Lenses And Surfaces, For Scar-Control On Implants And/Or For Congealing Blood And Fluids Into Uniform Thin Films For Surface and Micro-Analysis, And Manufacturing and Delivery Devices Thereof.* Ref. No: SiO₂ NanoTech Provisional Patent filed, Year: 02/2016
- Nicole Herbots, R.J. Culbertson, James Bradley, M.A. Hart, David A. Sell, Shawn Whaley: *US Patent 9018077 Methods for wafer bonding, and for nucleating bonding nanophases.* Ref. No: US Patent 9018077, Year: 04/2015
- Nicole Herbots, Clarizza F. Watson, Eric J. Culbertson, Pierre E. Thilmann, Mayuri Gupta, Saloni Sinha, Abijith Krishnan, Igor Pinheiro de Oliveira Martins, Nehal Gupta, Karlin McLeod: *Permanent Anti-*

Fog Coatings and Delivery Devices thereof, for Direct Application of Temporary, Semi-permanent and Permanent Anti-Fog Coatings on Lenses, Surfaces and Medical Devices as Wet Or Quickly Drying Coatings.
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