**CV – Kjeld Pedersen**

**Personal data**

Name Kjeld Pedersen

Appointment Professor, Head of Department

Place of work Department of Materials and Production, Aalborg University, Fibigerstræde 16, 9220 Aalborg East, Denmark

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Data of birth June 27, 1955, Viborg, Denmark

**Education**

*1980* M. Sc. Mechanical Engineering, Aalborg University.

1980/81 Military service

*1986* Ph.D. (Strain Measurements by Ellipsometry). Aalborg University.

**Appointments**

*1981 - 1983* Candidate-stipend (STVF), Aalborg University.

*1983 - 1986* Ph.D. student, Institute of Physics, Aalborg University

*1986 - 1990* Assistant Professor, Institute of Physics, Aalborg University.

*1988 - 1989* Visiting Scientist, Department of Physics, University of Toronto

*1990 - 2005* Associate Professor, Department of Physics, Aalborg University

*2005 -* Professor, Department of Physics and Nanotechnology, Aalborg University

*2002 - 2017* Head of Department of Physics, Aalborg University

*2017-* Appointed head of department, Materials and Production, Aalborg University

**Research focus**

**Thin film growth**: Deposition of thin crystalline metallic films on crystalline substrates under ultra high-vacuum conditions. Formation of quantum well states and engineering of energy levels through surface properties, buffer layers and film thickness. Growth III-nitride semiconductor films. Characterization of films by photoelectron spectroscopy and nonlinear optics.

**Nonlinear optical characterization of materials**: Characterization of surfaces and buried interfaces by optical second harmonic generation. Nonlinear optical characterization of film formation *in situ* during the growth process.

**Materials for solar energy**: Enhancement of light absorption in thin film solar cells by cell designs and inclusion of nanostructured materials. Plasmonic effects. High-temperature absorbers and emitters for thermo photovoltaics.

**Materials for power electronics**: Reliability of materials for packaging in power electronics converter systems. Test and modelling of bond wires and metal semiconductor interfaces. Development of bond wire characterization techniques.

**Teaching and supervision**

30 years of experience teaching engineers and physicists at university level, including specialized PhD courses.

Responsible for development of complete study plans in Materials Physics and in Nanotechnology. Responsible supervisor for 12 Ph.D. students, 50 M. Sc. Students.

Censorfor several Masters theses, Danish Technical University, Copenhagen University, University of Southern Denmark, Aarhus University

Censor for PhD theses at other universities in Denmark and abroad.

**Participation in larger research projects (2000-):**

Ulineær optik på metalliske kvantebrønde: Carlsbergfondet

NanoLab: Infrastruktur til nanoteknologi (Erhvervsstyrelsen 2005-10)

SEM and NanoImprint: Udstyr til nanoteknologisk forskning og udvikling (Obel, AAU/AU – iNANO)

INLED: Intelligent light emitting diodes (HTF with Martin Professional)

ANAP: Active nano plasmonics (FTP, together with SDU)

SERBINA, Sensitizing erbium with nanodots (FTP, together with AU)

PLATOS: Plasmon enhanced thin-film solar cells (Villum, together with AU)

THINC: Thin-film solar cell based on nanocrystalline silicon and structured backside reflectors (DSF together with AU))

CORPE: Center of reliable power electronics (DSF platform, with Energy Technology)

INLINE: Concentrated Solar Power (HTF, Polyteknik A/S and DTU)

PlasTPV: Plasmonic metal nanostructures for thermophotovoltaics (FTP, with SDU and Polyteknik A/S)

SIMS: High resolution depth profiling of materials for energy systems (Obel, Ib Henriksen)

SEMPEL: Semiconductor materials for power electronics (DSF, with AU and Topsil A/S)

APPET: Advanced Power Electronic Technology and Tools (with AAU-Energy)

X-POWER: National Infrastructure in Power Electronics (with AAU-Energy)

**Reviewing**

Ad hoc reviewer for Phys. Rev. B, Phys. Rev. Lett., Surface Science, J. Vac. Sci. Technol., Applied Physic Letters.

Reviewer for foreign research councils.

**Publications**

More than 150 journal papers. ORCID address: <https://orcid.org/0000-0002-6835-1566>

**Publications since 2012**

1. Esben Skovsen, Thomas Søndergaard, Jacek Fiutowski, Horst-Günter Rubahn, and Kjeld Pedersen, “Surface plasmon polariton generation by light scattering off aligned organic nanofibers”, J. Opt. Soc. B **29**, 249 (2012).
2. Jonas Beermann, Sergey M Novikov, Tobias Holmgaard Stær, René L Eriksen, Ole Albrektsen, Kjeld Pedersen, Sergey I Bozhevolnyi, ”Polarization-resolved two-photon luminescence microscopy of V-groove arrays” Optics Express, **20**, 654-662 (2012).
3. Esben Skovsen, Thomas Søndergaard, Jacek Fiutowski, Andreas Osadnik, Arne Lützen, Horst-Günter Rubahn, Sergey I Bozhevolnyi, Kjeld Pedersen, “Local excitation of surface plasmon polaritons by second-harmonic generation in crystalline organic nanofibers” Optics Express, **20**, 16715-16725 (2012).
4. Thomas Søndergaard, Sergey M Novikov, Tobias Holmgaard Stær, René L Eriksen, Jonas Beermann, Zhanghua Han, Kjeld Pedersen, Sergey I Bozhevolnyi, “Plasmonic black gold by adiabatic nanofocusing and absorption of light in ultra-sharp convex grooves”, Nature Communications, **3**, 1-6 (2012).
5. Søren Vejling Andersen and Kjeld Pedersen, “Second-harmonic generation from electron beam deposited SiO films”, Optics Express, **20**, 13857 (2012).
6. Esben Skovsen, Peter Fojan, Kjeld Pedersen,” Surface plasmon polaritons excitation by second-harmonic generation in KNbO3 nanowires deposited on thin Ag and Au films”. Proceedings of SPIE Vol. 842427, pp. 14308-14320 SPIE - International Society for Optical Engineering (2012).
7. Jens Rafaelsen, Kjeld Pedersen, and Zheshen Li, ” Size-effects in photoemission and optical second harmonic generation spectroscopy of Ge nano-dots on Si(111)”, J. Appl. Phys. **114**, 044304 (2013).
8. Beermann, Jonas ; Eriksen, René L. ; Stær, Tobias Holmgaard; Pedersen, Kjeld; Bozhevolnyi, Sergey, “Plasmonic black metals by broadband light absorption in ultra-sharp convex grooves” New Journal of Physics, **15**, 073007 (2013).
9. Yao-Chung, Eddy Tsao; Søndergaard, Thomas; Skovsen, Esben; Gurevich, Leonid; Pedersen, Kjeld; Pedersen, Thomas Garm, “Pore size dependence of diffuse light scattering from anodized aluminum solar cell backside reflectors”, Optics Express, **21**, p. A84-A95 (2013).
10. Jens Rafaelsen, Peter Kjær Kristensen, and Kjeld Pedersen, *Interface resonances in optical second-harmonic generation from oxide-covered Ge(111) and Ge(100)*, J. Opt. Soc. Am. **B 30**, 2758-2764 (2013).
11. Kristian Bonderup Pedersen, Peter Kjær Kristensen, Vladimir Popok, Kjeld Pedersen, *Micro-sectioning approach for quality and reliability assessment of wire bonding interfaces in IGBT modules,* Microelectronics Reliability **53,** 1422–1426 (2013).
12. E. Skovsen , T. Søndergaard , C. Lemke , T. Holmgaard , T. Leißner , R. L. Eriksen , J. Beermann , M. Bauer , K. Pedersen and S. I. Bozhevolnyi, *Plasmonic black gold based broadband polarizers for ultra-short laser pulses*, Appl. Phys. Lett. **103**, 211102 (2013).
13. Søren Vejling Andersen, Mads Lund Trolle, and Kjeld Pedersen, *Growth direction of oblique angle electron beam deposited silicon monoxide thin films identified by optical second-harmonic generation*, Appl. Phys. Lett. **103**, 231906 (2013).
14. Søren Raza, Nicolas Stenger, Anders Pors, Tobias Holmgaard Stær, Shima Kadkhodazadeh, Jakob B Wagner, Kjeld Pedersen, Martijn Wurbs, Sergey Bozhevolnyi, and Niels Asger Mortensen, Nature Communications **5**, 4125 (2014).
15. Søren V. Andersen, V. Vandelon, R. H. E. C. Bosch, B. W. van de Loo, Kjeld Pedersen, W. M. M. Kessels, *Interaction between O2 and ZnO films probed by time-dependent second-harmonic generation*, Appl. Phys. Lett. **104**, 051602 (2014).
16. Kristian Bonderup, David Benning, Peter Kjær Kristensen, Vladimir Popok, and Kjeld Pedersen, *Interface structure and strength of ultrasonically wedge bonded heavy aluminium wires in Si-based power modules*, Journal of Materials Science: Materials in Electronics **25**, 2863 (2014).
17. Thomas Søndergaard, Yao-Chung Tsao, Peter Kjær Kristensen, Thomas Garm Pedersen and Kjeld Pedersen, Journal of the Optical Society of America B **31**, 2036 (2014).
18. Jonas Beermann, René L. Eriksen, Tobias Holmgaard Stær, Kjeld Pedersen, Sergey Bozhevolnyi, *Plasmonic black metals via radiation absorption by two-dimensional arrays of ultra-sharp convex grooves*, Scientific Reports **4**, 6904 (2014).
19. Kristian Bonderup Pedersen, Peter Kjær Kristensen, Vladimir Popok, Kjeld Pedersen, *Degradation Assessment in IGBT Modules Using Four-Point Probing Approach*, IEEE Transactions on Power Electronics, **30**, 2405 (2015).
20. Giulio Biagi, Jacek Fiutowski, Ilya P Radko, Horst-Günter Rubahn, Kjeld Pedersen, Sergey I Bozhevolnyi, *Compact wavelength add–drop multiplexers using Bragg gratings in coupled dielectric-loaded plasmonic waveguides,* Optics Letters, **40**, 2429-2432 (2015).
21. Kristian Bonderup Pedersen, Lotte Haxen Østergaard, Pramod Ghimire, Vladimir Popok, Kjeld Pedersen, *Degradation mapping in high power IGBT modules using four-point probing,* Microelectronics Reliability, **55**, 1196-1204 (2015).
22. Sanjay Ram, Rita Rizolli, Derese Desta, Bjarke Rolighed Jeppesen, Michele Bellettato, Ivan Samatov, Yao-Chung Tsao, Sabrina R Johannsen, Pekka T Neuvonen, Thomas Garm Pedersen, Rui Nuno Marques Pereira, Kjeld Pedersen, Peter Balling, Arne Nylandsted Larsen. *Directly patterned TiO2 nanostructures for efficient light harvesting in thin film solar cells,* Journal of Physics D: Applied Physics*,* **48**, 365101 (2015).
23. Alexander Stylvester Roberts, Manohar Chirumamilla, Kasper Thilsing-Hansen, Kjeld Pedersen, Sergey Bozhevolnyi, *Near-infrared tailored thermal emission from wafer-scale continuous-film resonators,* Optics Express, **23** (2015).
24. Liqiong An, Syed Talat Ali, Thomas Søndergaard, Jeppe Nørgaard, Yao-Chung Tsao, Kjeld Pedersen, *Optimization of TiAlN/TiAlON/Si3N4 solar absorber coatings*, Solar Energy, **118**, 410-418 (2015).
25. Ana G. Silva, Kjeld Pedersen, Zheshen S. Li, Per Morgen, *Photoelectron spectroscopy as an in situ contact-less method for studies of MOS properties of ultrathin oxides on Si*, Applied Surface Science **353**, 1208–1213 (2015).
26. Yao-Chung Tsao, Thomas Søndergaard, Peter Kjær Kristensen, Rita Rizolli, Kjeld Pedersen, Thomas Garm Pedersen, *Rapid fabrication and trimming of nanostructured backside reflectors for enhanced optical absorption in a -Si:H solar cells*, Applied Physics A **120**, 417-425 (2015).
27. Paw Simesen, Thomas Søndergaard, Esben Skovsen, Jacek Fiutowski, Horst-Günter Rubahn, Sergey I Bozhevolnyi, Kjeld Pedersen, *Surface plasmon polariton excitation by second harmonic generation in single organic nanofibers*, Optics Express, **23,** 16356-16363 (2015).
28. Mads Brincker, Kjeld Pedersen, Esben Skovsen, *Tunable local excitation of surface plasmon polaritons by sum-frequency generation in ZnO nanowires*, Optics Communications, **356**, 109-112 (2015).
29. Paw Simesen, Kristian Bonderup Pedersen, Kjeld Pedersen; *Second-harmonic scanning microscopy of domains in Al wire bonds in IGBT modules*, Optics Express, **23**, 33466-33471 (2015).
30. Mads Lund Trolle, Yao-Chung Tsao, Kjeld Pedersen, Thomas Garm Pedersen*, Observation of excitonic resonances in the second harmonic spectrum of MoS2*, Phys. Rev. B **92**, 161409 (2015).
31. Dennis Achton Nielsen, Vladimir Popok, Kjeld Pedersen, *Modelling and experimental verification of tip-induced polarization in Kelvin probe force microscopy measurements on dielectric surfaces*, J. Appl. Phys. **118**, 195301 (2015).
32. Kristian Bonderup Pedersen, Kjeld Pedersen, *Dynamic Modelling Method of Electro-Thermo-Mechanical Degradation in IGBT Modules*, IEEE Transactions of Power Electronics, **31**, 975-986 (2015)
33. Vladimir Popok, Kristian Bonderup Pedersen, Peter Kjær Kristensen, Kjeld Pedersen, *Comprehensive physical analysis of bond wire interfaces in power modules*, Microelectronics Reliability, **58**, 58-64 (2016).
34. Kristian Bonderup Pedersen, Lotte Haxen Østergaard, Peter Kjær Kristensen, Pramod Ghimire, Vladimir Popok, Kjeld Pedersen, *Degradation evolution in high power IGBT modules subjected to sinusoidal current load*, Journal of Materials Science: Materials in Electronics, **27**, 1938-1945 (2016).
35. Jesper Gadegaard, Thøger Kari Jensen, Dennis Thykjær Jørgensen, Peter Kjær Kristensen, Thomas Søndergaard, Thomas Garm Pedersen, Kjeld Pedersen, *High-output LED-based light engine for profile lighting fixtures with high color uniformity using freeform reflectors*, Applied Optics, **55**, 1356-1365 (2016).
36. Alexander Roberts, Thomas Søndergaard, Manohar Chirumamilla, Anders Pors, Jonas Beermann, Kjeld Pedersen, Sergey Bozhevolnyi*, Light extinction and scattering from individual and arrayed high-aspect-ratio trenches in metal*, Phys. Rev. B **93**, 075413 (2016).
37. Manohar Chirumamilla, Alexander Roberts, Fei Ding, Deyong Wang, Peter Kjær Kristensen, Sergey Bozhevolnyi, Kjeld Pedersen, *Multilayer tungsten-alumina-based broadband light absorbers for high-temperature applications*, Optical Materials Express, **6**, 2704-2714 (2016).
38. Hans Ulrik Ulriksen and Kjeld Pedersen, *Field enhancement at silicon surfaces by gold ellipsoids probed by optical second-harmonic generation spectroscopy*, J. Appl. Phys. **120**, 235307 (2017).
39. Ana Christina Gomes silva, Kjeld Pedersen, Zheshen Li,Jeanette Hvam, Rajnish Dhiman and Per Morgen, *Growth of aluminum oxide on silicon carbide with an atomically sharp interface*, Journal of Vacuum Science & Technology A**35**, 01B142 (2017).
40. Manohar Chirumamilla, Anisha Chirumamilla, Alexander Roberts, Remo Proietti Zaccaria, Francesco De Angelis, Peter Kjær Kristensen, Roman Krahe, Dergey I Bozhevolnyi, Kjeld Pedersen and Andrea Toma, *Hot-Spot Engineering in 3D Multi-Branched Nanostructures : Ultrasensitive Substrates for Surface-Enhanced Raman Spectroscopy*, Advanced Optical Materials **4**, 1600836 (2017).
41. Mariia M. Rozhavskaia, Sergey Kukushkin, Andrey Osipov, Alexandr V. Myasoedov, Sergey I. Troshkov, Lev M. Sorokin, Pavel N. Brunkov, Alexandr V. Baklanov, Rodion S. Telyatnik, Raghavendra Rao Juluri, Kjeld Pedersen and Vladimir Popok, *Metal organic vapor phase epitaxy growth of (Al)GaN heterostructures on SiC/Si(111) templates synthesized by topochemical method of atoms substitution*, Physica Status Solidi A **7**, 1700190 (2017).
42. Dennis Achton Nielsen; Vladimir Popok, Kjeld Pedersen, *Simulation and Verification of Tip-Induced Polarization During Kelvin Probe Force Microscopy Measurements on Film Capacitors*, 3rd International Multidisciplinary Microscopy and Microanalysis Congress (InterM): Proceedings, Oludeniz, Turkey, 19-23 October 2015. Ed A.Y. Oral; Z.B. Bahsi Oral. Springer Proceedings in Physics **186**, 215-221 (2017).
43. Kristian Bonderup Pedersen, Peter Kjær Kristensen, Kjeld Pedersen, Christian Uhrenfeldt and Stig Munk-Nielsen, *Vce as early indicator of IGBT module failure mode*, 2017 IEEE International Reliability Physics Symposium (IRPS) DOI: 10.1109/IRPS.2017.7936371 (2017).
44. Kristian Bonderup Pedersen, Dennis Achton Nielsen, Bernhard Czerny, Golta Khatibi, Francesco Iannuzzo, Vladimir Popok and Kjeld Pedersen, *Wire bond degradation under thermo- and pure mechanical loading*, Microelectronics Reliability **76-77**, 373–377 (2017).
45. Manohar Chirumamilla, Anisha Chirumamilla, Yuanqing Yang, Alexander S. Roberts, Peter Kjær; Kristensen Krishnakali Chaudhuri, Alexandra Boltasseva, Duncan Sutherland, Sergey I Bozhevolnyi, Pedersen, Kjeld, *Large‐Area Ultrabroadband Absorber for Solar Thermophotovoltaics Based on 3D Titanium Nitride Nanopillars*, Advanced Optical Materials, **5**, 1700552, (2017).
46. Enok Johannes Haahr Skjølstrup, Thomas Søndergaard, Kjeld Pedersen, Thomas Garm Pedersen, *Optics of multiple grooves in metal: Transition from high scattering to strong absorption*, Plasmonics: Design, Materials, Fabrication, Characterization, and Applications XV. SPIE - International Society for Optical Engineering, Vol. 10346, p. 1-12 (2017).
47. Enok Johannes Haahr Skjølstrup, Thomas Søndergaard, Kjeld Pedersen, Thomas Garm Pedersen, *Optics of multiple grooves in metal: Transition from high scattering to strong absorption*, Journal of Nanophotonics, **11**, 046023, (2017).
48. Sungyoung Song, Stig Munk-Nielsen, Christian Uhrenfeldt, Kjeld Pedersen, *Power cycling test of a 650 V discrete GaN-on-Si power device with a laminated packaging embedding technology,* Proceedings of 2017 IEEE Energy Conversion Congress and Exposition (ECCE). IEEE Press, 2540-2545 (2017).
49. Rasmus Hjelmgart Godiksen, Thore Stig Aunsborg, Peter Kjær Kristensen, Kjeld Pedersen, *Two-photon photoluminescence and second-harmonic generation from unintentionally doped and semi-insulating GaN crystals,* Applied Physics B **123**, 270, (2017).
50. Raghavendra Juluri Rao, John Hansen Lundsgaard, Peter Kjær Kristensen, Brian Julsgaard, Kjeld Pedersen, *Optical characterization of SiC films grown on Si(111)*, Applied Physics B **124**, 124230 (2018).
51. Alexander Roberts, Manohar Chirumamilla, Deyong Wang, Liqiong An, Kjeld Pedersen, N. Asger Mortensen, Sergey I Bozhevolnyi, *Ultra-thin titanium nitride films for refractory spectral selectivity*, Optical Materials Express, **8** 3717-3728 (2018).
52. V. Popok, T.S. Aunsborg, R. H. Godiksen, P.K. Kristensen, R.R. Juluri, P. Caban, and K. Pedersen, *Structural Characterization of MOVPE Grown AlGaN/GaN for HEMT Formation*, Advanced Materials Science **57**, 72-81 (2018).
53. P. Caban, R. Thorpe, L. Feldman, K. Pedersen, and V. Popok, *AlGaN/GaN Heterostructures in High Electron Mobility Transistors*, Proceedings of VIII International Conference on Materials and Structures of Modern Electronics. Odzaev, V. B. (Ed.). Minsk: BSU, p 5-8 (2018).
54. H. U Ulriksen, T.M. Søndergaard, T.G. Pedersen, and K. Pedersen, *Plasmon enhanced light scattering into semiconductors by aperiodic metal nanowire arrays*, Optics Express, **27** 14308-14320 (2019).