Dr. Hilde Helen Hardtdegen

Scientific staff at Ernst Ruska-Centre (ER-C2)

Applied Nanomaterials

Address

Forschungszentrum Jülich GmbH

Wilhelm-Johnen-Straße

52428 Jülich

Contact

Phone: +49 2461 61-2360

Email: h.hardtdegen@fz-juelich.de

Curriculum Vitae

Dr. Hilde Helen Hardtdegen

Research / Work experience

Since 2017	staff scientist and group leader at the Ernst Ruska-Centre (ER-C2) Forschungszentrum Jülich GmbH, section “Applied Nanomaterials”
1990-2017	staff scientist and group leader at the Institute of Thin Films and Interfaces, now Peter Grünberg Institute, Forschungszentrum Jülich GmbH, responsible for metalorganic vapor phase epitaxy and characterization of semiconductor structures for device applications
1996	visiting scientist at the Institute of Solid State Physics, TU Berlin
1988-1990	post doc position at Institute of Thin films and Ion Technology, Forschungszentrum Jülich GmbH
1988-1989	visiting scientist at the Institute of Semiconductor Technology, RWTH Aachen
1984-1988	research scientist at the Institute of Inorganic Chemistry, RWTH Aachen
1983-1984	research assistant at the Institute of Inorganic Chemistry, RWTH Aachen

Education

1987	PhD, thesis: “Alkalichalkogenomanganate”, Institute of Inorganic Chemistry, RWTH Aachen, supervisor Prof. Dr. W. Bronger
1977-1984	Diploma in chemistry, RWTH Aachen

Research Interests

Dr. Hilde Helen Hardtdegen

Permanent staff member of the Ernst Ruska-Centre (ER-C2) and leader of the section Applied Nanomaterials.

The Applied Nanomaterials group focuses on the characterization of nanomaterials for different applications such as in the fields of information technology and energy.

Expertise and Research Interests

- Metalorganic gas phase epitaxy of group III – group V semiconductors, group III-nitrides and Ge-Sb-Te thin films and nanostructures; in situ optical characterization of thin film growth
- Optoelectronic and structural characterization of nanostructures and devices
- Correlative investigation of functional (especially with Raman / photoluminescence) characteristics with atomic structure (transmission electron microscopy) also operando

Honors and Committees

- Gaede Award of the German Vacuum Society (1997)
- Editor in Chief of "Progress in Crystal Growth and Characterization of Materials" (Elsevier, reviews upon invitation, since 2014)
- Elected by the board of directors Research Center Juelich for the 2 year program "Career Building for Women in Science" (2000)

Program Committees:
EW-MOVPE (since 1998), IC-MOVPE (since 2002), Organization of the 15th EWMOVPE, June 2-5, 2013 in Aachen

Journal Reviewing Responsibilities:
Journal of Applied Physics, Applied Physics Letters, Journal of Crystal Growth, Journal of the Electrochemical Society, Journal of Electronic Materials, Physical Status Solidi, Surface Science, Applied Surface Science, Thin Solid Films, NanoLetters, ACS Nano, Nature, Nanotechnology

Research proposal reviewing responsibilities:
DFG; US DoE, Office of Science; ANR (France); FWF Austria; SRDA (Slovakia), TA CR (Czech Republic)

External PhD defense committees:
KTH, Stockholm, Sweden; Aalto University, Helsinki, Finland; Université du Luxembourg, Luxemburg, Alagappa University India

- Member of the committee for internal suggestions for improvement at the FZJ
- Memberships in societies:
  GDCh, DPG, DVG, DGKK

Projects

Collaborative Research Center SFB 917 “Nanoswitches” with Aachen University
• 2011-2015: “Self assembled phase-change nanowires”
• 2015-2019: “Highly textured phase change nanostructures for low power devices”

European Project FP7 NMP
“SYNAPSE”: Synthesis and functionality of chalcogenide nanostructures for phase change memories (2012 –2015)

German Ministry for Education and Research:
• EPHQUAM: Efficient compact and controllable single photon sources for quantum communication (2009-2012)
• QPENS: GaAs and GaN based quantum dot emitters and optimized detection electronics for system investigation with respect to quantum cryptography and transfer protocols (2008-2011)

Innovationsfonds of the Research Center Jülich
• MOVPE double reactor system (1998)
• High Resolution X-ray Diffractometer (2005)

Project of the North Rhine Westphalian government:
Cooperation with RWTH Aachen and AIXTRON GmbH: MOVPE of GaN and devices for high frequency applications (2000 – 2003)

Selected Publications

FZJ-2022-01764

[1] M. Mikulics, J. Mayer, H.H. Hardtdegen, Cutting-edge nano-LED technology, J. Appl. Phys. 131 (2022) 110903. https://doi.org/10.1063/5.0087279

FZJ-2021-03351

[2] M. Mikulics et al., Local increase in compressive strain (GaN) in gate recessed AlGaN/GaN MISHFET structures induced by an amorphous AlN dielectric layer, Semicond. Sci. Technol. 36 (2021) 095040. https://doi.org/10.1088/1361-6641/ac1a28

FZJ-2020-04181

[3] M. Mikulics and H.H. Hardtdegen, Fully photon operated transmistor / all-optical switch based on a layered Ge1Sb2Te4 phase change medium, FlatChem. 23 (2020) 100186. https://doi.org/10.1016/j.flatc.2020.100186

FZJ-2017-02120

[4] M. Mikulics et al., P. Kordoš, A. Fox, M. Kočan, H. Lüth, Z. Sofer, H. Hardtdegen, Efficient heat dissipation in AlGaN/GaN heterostructure grown on silver substrate, Appl. Mater. Today. 7 (2017) 134–137. https://doi.org/10.1016/j.apmt.2017.02.008

FZJ-2016-02325

[5] H. Hardtdegen et al., A model structure for interfacial phase change memories: Epitaxial trigonal Ge1Sb2Te4, J. Alloys Compd. 679 (2016) 285–292. https://doi.org/10.1016/j.jallcom.2016.04.013

FZJ-2015-07751

[6] H. Hardtdegen et al., Modern chemical synthesis methods towards low-dimensional phase change structures in the Ge–Sb–Te material system, Prog. Cryst. Growth Charact. Mater. 61 (2015) 27–45. https://doi.org/10.1016/j.pcrysgrow.2015.10.001

FZJ-2015-02658

7] M. Mikulics et al., Reduction of skin effect losses in double-level-T-gate structure, Appl. Phys. Lett. 105 (2014) 232102. https://doi.org/10.1063/1.4903468

[8] N. Thillosen et al.,, The State of Strain in Single GaN Nanocolumns As Derived from Micro-Photoluminescence Measurements, Nano Lett. 6 (2006) 704–708. https://doi.org/10.1021/nl052456q

[9] H. Hardtdegen et al., In situ characterization of GaAs growth in nitrogen atmosphere during MOVPE: A comparison to hydrogen atmosphere, J. Cryst. Growth. 195 (1998). https://doi.org/10.1016/S0022-0248(98)00705-2

[10] H. Hardtdegen et al., MOVPE growth of GaAs using a N2 carrier, MOVPE growth of GaAs using a N_2 carrier, J. Cryst. Growth. 124 (1992) 420–426. https://doi.org/10.1016/0022-0248(92)90494-4

Complete publications

Google Scholar: https://scholar.google.com/citations?user=-Ap-VC0AAAAJ&hl=en

Publons Researcher ID: https://publons.com/researcher/2563519/hilde-h-hardtdegen/

ORCID: https://orcid.org/0000-0003-0445-6489

Patents/granted:

Apparatus for depositing compounds on a substrate by means of metalorganic chemical vapor deposition
H. Hardtdegen, N. Kaluza, Y. Makarov, R. Schmidt, K. Wirtz
EP patent: EP1608794B1 (2009)
KR patent: KR101105629B1 (2012)

High frequency conductor having improved conductivity
M. Mikulics, H. Hardtdegen, D. Grützmacher
US patent: US9735247B2 (2017)
EP patent: EP2987179B1 (2017)
JP patent: JP6244450B2 (2017)
CN: CN105493246B (2018)

Method for optical transmission of a structure into a recording medium
M. Mikulics and H. Hardtdegen
US patent: US9798237B2 (2017)
EP patent: EP2885677B1 (2016)
JP patent: JP6177912B2 (2017)
CN patent: CN104662477B (2017)
KR patent: KR102191802B1 (2020)

Single-photon source suitable for mass production and production method
M. Mikulics and H. Hardtdegen
US patent: US10074771B2 (2018)
EP patent: EP2936628B1 (2017)
JP patent: JP6244371B2 (2017)
CN patent: CN105379033B (2018)

Patents/applications:
Component having optically active materials
M. Mikulics and H. Hardtdegen
WO2020114532A1

Bauelementstruktureinheit
M. Mikulics and H. Hardtdegen
WO2021115507A1

Teaching

Research Center Jülich:
Author Workshop: "How to write a world-class paper", author issues, the review process and publishing ethics

Spring School of Research Center Jülich:
Deposition Methods: Chemical Vapor Deposition

Summer School "Nanoswitches":
Synthesis of Nanowires

Students supervised:

PhD thesis:

Anna Haab (2018)
Indium Gallium Nitride Nanostructures for Optoelectronic Applications
Sally Rieß (2017)
Metallorganische Gasphasenepitaxie (MOVPE) und Charakterisierung des Phasenwechselmaterials Ge-Sb-Te
Kamil Sladek (2013)
Realization of III-V semiconductor nano structures towards more efficient (opto-) electronic devices
Yong Suk Cho (2008)
MOVPE Growth and Characterization of Cr-doped GaN
Roger Steins (2006)
New Process Approaches to Metalorganic Vapor Phase Epitaxy of III-nitrides for High Power HEMTs
Jens Knobbe (2004)
Rashba-Effekt in niedrigdimensionalen InGaAs/InP Strukturen
Nicoleta Kaluza (2003)
MOVPE Growth and Characterization of AlGaN/GaN Heterostructures for HEMT Application
Roland Schmidt (2001)
Metallorganische Molekularstrahlepitaxie von InP auf GaAs-Substraten für die Herstellung metamorpher Hochfrequenztransistoren
Dorothea Gauer (2001)
MOVPE von (AlGaIn)P unter dem Trägergas Stickstoff für LED-Strukturen
Andreas Kaluza (2000)
MOVPE-Wachstum und Charakterisierung von V-Graben Quantendrähten im Materialsystem AlGaAs/GaAs
Christoph Ungermanns (1998)
Metallorganische Molekularstrahlepitaxie von Verbindungshalbleitern auf Arsenid- und Antimonidbasis
Martin Hollfelder (1996)
Wachstum von InP basierenden Heterostrukturen mit N_2 als Trägergas in der LP MOVPE
Ralf Meyer (1994)
$Ga_{(1-x)}In_{(x)}As/InP$- Heterostrukturen für die Höchstfrequenzelektronik: Herstellung und Charakterisierung

Diplom / master thesis

Kristof Keller (2016)
Metalorganic Vapor Phase Epitaxy and Characterization of Indium-Antimony-Tellurium Nanostructures

Teresa Nolte (2015)
Design, growth and characterization of III-nitride based multi quantum well structures for optoelectronic applications

Marcel Schreiber (2014)
Entwicklung von LED-Strukturen als Basis für Einzel-Photonenquellen

David Griesche(2010)
Herstellung und Charakterisierung von Galliumnitrid-Nanostrukturen durch Trockenätzpräparationen

Anna Haab (2010)
Selektive metallorganische Gasphasenepitaxie von Gruppe-III-Nitrid Nanostrukturen

Andreas Penz (2010)
Optimierung der MOVPE von III-As Halbleiter-Nanodrähten

Kamil Sladek (2009)
Realisierung und Optimierung modulationsdotierter GaAs/AlGaAs Core-Shell Nanodrähte

Vera Klinger (2007)
Konformales Wachstum von AlGaAs auf strukturierten GaAs-Substraten mittels MOVPE

Roger Steins (2003)
Metalorganic Vapor Phase Epitaxy and Characterization of GaN

Nicolas Thillosen (2002)
Optische Charakterisierung von Nitriden hergestellt mittels MOVPE

Roland Schmidt (1998)
Beurteilung der optischen Eigenschaften von AlGaInP hergestellt in der metallorganischen Gasphasenepitaxie unter Stickstoff- oder Wasserstoffatmosphäre

Michael Matt (1997)
Untersuchungen zum Wachstum von InAs und GaSb mittels metallorganischer Molekularstrahlepitaxie

Schang-jing Hon (1996)
Untersuchungen zur Deposition von GaInP/AlGaInP mittels LP-MOVPE mit N_2 als Trägergas

Barbara Setzer (1995)
Charakterisierung und Wachstum von GaInP und AlGaInP mittels LP-MOVPE and N_2 als Trägergas

Christoph Ungermanns (1994)
Optimierung der Niedrigdruckgasphasenepitaxie von Al(x)Ga(1-x)As/GaAs mit N_2 als Trägergas

Martin Hollfelder (1993)
Verwendbarkeit von N_2 als Trägergas bei der Niedrigdruck- Gasphasenepitaxie von GaAs and $Al_{(x)}Ga_{(1-x)}As$