

## PUBLICATIONS

1. Q1 [4.816] – JOURNAL PAPER – S. Falina, H. Kawarada, A.A. Manaf, M. Syamsul, "High Temperature Performance of Enhanced Endurance Hydrogen Terminated Transparent Polycrystalline Diamond FET", IEEE Electron Device Letters, vol. 43, no. 7, pp. 1101-1104, 2022, DOI: 10.1109/LED.2022.3175473.
2. Q2 [3.523] – JOURNAL PAPER – K. M. Arshad, M. M. Noor, A. A. Manaf, H. Kawarada, S. Falina, M. Syamsul, "A Comparative Modelling Study of New Robust Packaging 2 Technology 1mm2 VCSEL Packages and Their Mechanical Stress Properties", Micromachines 2022, 13(9), 1513; <https://doi.org/10.3390/mi13091513>.
3. Q2 [3.523] – JOURNAL PAPER – M. Haziq, S. Falina, A.A. Manaf, H. Kawarada, M. Syamsul, "Challenges and Opportunities for High-Power and High-Frequency AlGaN/GaN High-Electron-Mobility Transistor (HEMT) Applications: A Review", 2022, Accepted.
4. Q4 [0.942] – JOURNAL PAPER – M. Mansor, N.S. Shiong, M. , Syamsul ; Y. Yusof, N.A. Rahman, "Atomic Structure for AlN Grown on Different Plane Orientation of Sapphire via Numerical Study", Microelectronics International, Vol. ahead-of-print No. ahead-of-print. 2022. , DOI: 10.1108/MI-04-2022-0065
5. Q4 [0.942] – JOURNAL PAPER – Mohd Arshad, K., Mat Noor, M., Manaf, A.A., H., Kawarada, S., Falina and M., Syamsul, 2022, "Packaging design and thermal analysis for 1 mm2 high power VCSEL", Microelectronics International, Vol. ahead-of-print No. ahead-of-print. 2022, DOI:10.1108/MI-03-2022-0048.
6. Q4 [0.346] – JOURNAL PAPER – M. A. C. Seliman, Z. Hassan, A. S. Yusof, M. A. Ahmad, N. A. Hamzah, R. I. M. Asri, M.I.M. Taib, M. Syamsul, 2022, "Effects of different growth temperatures towards indium incorporation in InGaN quantum well heterostructure", Int. J. Nanotechnol., Vol. 19, No. 2-5, pp. 336-343, 2022, DOI: 10.1504/IJNT.2022.124513.
7. Q4 [0.346] – JOURNAL PAPER – M. Hasnan, S. A. A. Abdalmoammed, R.I.M Asri, M. Nuzaihan, M. Inaba, H. Kawarada, Z. Hassan, S. Falina, M. Syamsul, " High-sensitivity Room Temperature P-doped and Undoped GaN Thin Film Resistive Gas Sensor", Int. J. Nanotechnol., Vol. 19, No. 2-5, pp. 418-429, 2022, DOI: 10.1504/IJNT.2022.124520.
8. BOOK CHAPTER – N. I. M. Ikhwan, M. F. P. Mohamed, M. F. A. J. Khan, N. A. Ghazali, A. A. Manaf, M. Syamsul, M. H. Hairi, A. F. A. Rahim, "2D Physical Modelling of Double  $\delta$ -Doped pHEMT with Tensile InAlAs Barrier and Compressive InGaAs Channel", Proceedings of the 11th International Conference on Robotics, Vision, Signal Processing and Power Applications, Lecture Notes in Electrical Engineering, pp 884–889, 2022, DOI: 10.1007/978-981-16-8129-5\_135
9. Q2 [3.523] – JOURNAL PAPER – M.F.P. Mohamed., M. F. M. Omar, Muhammad F. A. J. Khan, N. A. Ghazali, M. H. Hairi, S. Falina, M. Syamsul, "New Submicron Low Gate Leakage In0.52Al0.48As-In0.7Ga0.3As pHEMT for Low-Noise Applications", Micromachines, 12(12), 1497, 2021, DOI: 10.3390/mi12121497.
10. Q1 [5.743] – JOURNAL PAPER – S. Falina, M. Syamsul , N. A. Rhaffor, S. S. Hamid, K. A. M. Zain, A. A. Manaf, H. Kawarada, "Ten years progress of electrical detection of heavy metal ions (HMIs) 2 using various field-effect transistor (FET) nanosensors and high electron mobility transistor (HEMT): A review", Biosensor (Switzerland), 11 (12), 4782021, 2021, DOI: 10.3390/bios1112047
11. Q3 [2.170] – JOURNAL PAPER – Y.H. Chang, Y. Iyama, K. Tadenuma, S. Kawaguchi, T. Takarada, S. Falina, M. Syamsul and H. Kawarada, "Over 59 mv/ph sensitivity with fluorocarbon thin film via Fluorine Termination for pH sensing using Boron-doped Diamond Solution-gate Field-effect Transistors", Physica Status Solidi (a), 218 (5), pp. 2000278, 2021, DOI:10.1002/pssa.202000278
12. Q3 [2.170] – JOURNAL PAPER – S.Falina, K. Tanabe, Y. Iyama, K. Tadenuma, T. Bi, Y. H. Chang, A. A. Manaf, M. Syamsul and H. Kawarada, "Feasibility study of TiO2 encapsulation of diamond solution-gate field-effect transistor metal contacts for miniature biosensor applications, Physica Status Solidi (a), 217 (23), pp. 2000634, 2020, DOI:10.1002/pssa.202000634.
13. BOOK CHAPTER – H.F.A. Marzuki, E.A.E. Ubaidillah, S.A. Sivarasa, M. Syamsul, M. Jaafar, "Study on Effect of Fiber Orientation on Flexural Properties of Glass Fiber Reinforced Epoxy Composite Laminates for Structural Applications", in SSP vol. 301, pp. 227–237, 2020, DOI:10.4028/www.scientific.net/ssp.301.227.
14. CONFERENCE PAPER – N.M. Nashaain, S. Falina, Y. Kitabayashi, D. Matsumura, AA. Manaf, Z. Hassan, M. Syamsul, H. Kawarada, "Reliability of 2DEG Diamond FET by Harsh-Continuous Stress Voltage Approach," in 2020 4th IEEE Electron Devices Technology & Manufacturing Conference (EDTM), Penang, Malaysia, pp. 1-3, 2020, DOI: 10.1109/EDTM47692.2020.9117897.
15. Q2 [3.806] – JOURNAL PAPER – S. Falina, M. Syamsul, Y. Iyama, M. Hasegawa, Y. Koga and H. Kawarada, " Carboxyl-functionalized graphene SGFET: pH sensing mechanism and reliability of anodization" in Diamond and Related Materials Diamond and Related Materials, vol. 91, pp. 15-21, 2019, DOI: 10.1016/j.diamond.2018.11.005.
16. Q1 [3.031] – JOURNAL PAPER – S. Falina, S. Kawai, N. Oi, H. Yamano, T. Kageura, E. Suaebah, M. Inaba, Y. Shintani, M. Syamsul, and H. Kawarada, "Role of carboxyl and amine termination on boron-doped diamond solution gate field effect transistor for pH sensing," Sensors, Sensors, 18(7) 2018, 2178, DOI: 10.3390/s18072178.
17. Q1 [4.816] – JOURNAL PAPER – M. Syamsul, N. Oi, S. Okubo, T. Kageura and H. Kawarada, "Heteroepitaxial diamond field effect transistor" in IEEE Electron Device Letters vol. 39, no. 1, pp. 51-54, 2018, DOI:10.1109/LED.2017.2774290.
18. Q1 [4.816] – JOURNAL PAPER – M. Syamsul, Y. Kitabayashi, K. Takuya, D. Matsumura and H. Kawarada, "High Voltage Stress Induced in Transparent Polycrystalline Diamond Field-Effect Transistor and Enhanced Endurance Using Thick Al2O3 Passivation Layer," in IEEE Electron Device Letters, vol. 38, no. 5, pp. 607-610, 2017, DOI: 10.1109/LED.2017.2685081.

# MOHD SYAMSUL

## RESEARCHER / SENIOR LECTURER

### CONTACTS

+6013-467 9767 / +604-653 5658

nasyriq@usm.my

Institute Of Nano Optoelectronics Research And Technology (INOR)

Sains@USM, Block A, Ground Floor

No.10, Persiaran Bukit Jambul

11900 Bayan Lepas, Penang,

MALAYSIA

Scopus ID: 57192007640

Orcid ID: 0000-0002-3236-3303

Researcher ID: G-2047-2017

### CURRENT RESEARCH

Ultra-wide bandgap materials (GaN and Diamond)

Electron devices

Power electronics

Novel sensors and biosensors

Website:



## EDUCATION

**Ph.D.**, Nanoscience and Nanoengineering  
Waseda University, Japan  
2014-2017

**MSc.**, Nanoelectronic Engineering  
Universiti Malaysia Perlis (UniMap),  
Malaysia  
2011-2013

**BEng (Hons)**, Microelectronic Engineering  
Universiti Malaysia Perlis (UniMap),  
Malaysia  
2005-2009

19. Q1 [3.971] – JOURNAL PAPER – M. Syamsul, Y. Kitabayashi, D. Matsumura, T. Saito, Y. Shintani and H. Kawarada, "High voltage breakdown (1.8 kV) of hydrogenated black diamond field effect transistor," Appl.Phys.Lett., vol. 109, no. 20, pp. 203504, 11/14; 2017/01 2016. DOI: 10.1063/1.4967999.
20. Q1 [4.816] – JOURNAL PAPER – Y. Kitabayashi, T. Kudo, H. Tsuboi, T. Yamada, D. Xu, M. Shibata, D. Matsumura, Y. Hayashi, M. Syamsul, M. Inaba, A. Hiraiwa, and H. Kawarada, "Normally-off C-H Diamond MOSFETs with Partial C-O Channel Achieving 2-kV Breakdown Voltage," IEEE Electron Device Lett., vol. 38, no. 3, pp. 363 - 366 , 2017, DOI: 10.1109/LED.2017.2661340.

## PATENTS

PATENT – Japan Patent Office (JPO) P170013925

Inventor: Mohd Syamsul Nasyriq

Patent number: JP 2017-045897

Release date: March 2, 2017

Invention: "ダイヤモンド電界効果トランジスタ及びその製造方法"  
(Diamond field effect transistor fabrication)

## RESEARCH GRANTS

1. NATIONAL GRANT (Principal Investigator) – Fundamental Research Grant Scheme (FRGS 2022) – "A Stability Study of Advanced Potentiometric Water-Gated Configuration using AlGaIn/GaN High Electron Mobility Transistor (WGHEMT) for Multiplex Herbicide Detection" – [RM 174,160.00], 2022-2025
2. INTERNATIONAL GRANT (Principal Investigator) – JICA Project for AUN/SEED-Net – "AlGaIn/GaN High-Electron-Mobility Transistor (HEMT) for SARS-CoV-2 (COVID-19) Rapid Detection" – [USD 49,090] , 2020-2021
3. INDUSTRIAL GRANT (Co-Investigator) – Collaborative Research In Engineering, Science And Technology Center (CREST) – "GaN-on-GaN Light Emitting Diodes (LEDs)" – [RM 620,200.00], 2021-2022
4. INTERNATIONAL GRANT (Co-Investigator) – JICA Project for AUN/SEED-Net – "Lab-on Polyimide: Flexible inkjet-printed graphene-based field-effect transistor (GFET) for self-screening COVID-19" – [USD 26,859] , 2020-2021
5. INTERNATIONAL GRANT (Co-Investigator) – "Material science of complex defects for highly-sensitive quantum sensors", Q-LEAP, Japan Science and Technology Agency (JST), Japan
6. INDUSTRIAL GRANT – Biogenes Technologies Sdn Bhd (Principal Investigator) – "Development of Aptamer and Portable AlGaIn/GaN HEMT Biosensor Reader For The Detection Of SARS-CoV-2" – [MYR 31,500] , 2021-2022
7. INDUSTRIAL GRANT – Biogenes Technologies Sdn Bhd (Principal Investigator) – "RAPID DETECTION OF COVID-19 CAUSATIVE VIRUS (SAR-CoV-2) VIA N-PROTEIN BY GRAPHENE FIELD-EFFECT TRANSISTOR (FET) BIOSENSOR – [MYR 31,500] , 2021-2022
8. NATIONAL GRANT (Co-Investigator) – Fundamental Research Grant Scheme (FRGS 2019) – Fabrication and Characterization of Zinc Borosilicate Glass Doped with Dysprosium (III) Oxide Nanoparticles for Solid State Lighting Technology of White Light Generation – [MYR 98,150] , 2019-2022
9. NATIONAL GRANT (Co-Investigator) – Fundamental Research Grant Scheme (FRGS 2019) – Mechanism of nitridation on high miscut-angle sapphire substrate to improve AlN underlying layer for highly efficient III-nitride devices – [MYR 146,230] , 2019-2022
10. NATIONAL GRANT (Co-Investigator) – Fundamental Research Grant Scheme (FRGS 2019) – Investigation of Passivating Mechanism and Metal-Oxide-Semiconductor Characteristics of Trivalent Ce doped Gallium Oxide on Wide Bandgap Semiconductors – [MYR 135,000] , 2019-2022
11. INTERNAL GRANT (Principal Investigator) – "Diamond as photocatalysts" – [MYR 22,900] , 2019-2020
12. INTERNAL GRANT (Principal Investigator) – "Cost effective polycrystalline diamond transistor for power electronics" – [MYR 41,000] , 2021-2023

## SUPERVISION

### Main supervision

Active:

1. Najihah Binti Mohd Fauzi, 2021, PhD, The Investigation of Gallium-Nitride Semiconductor Power Electronics Reliabilities.
2. Muhaimin Haziq Bin Mihat, 2021, PhD, Modelling and Simulation of GaN Power Devices,
3. Khairul Bin Mohd Arshad, 2021, PhD, Design and Optimization of Diffuser Integrated Module for Vertical Cavity Surface Emitting Laser (VSCSEL).
4. Zikri Bin Zulkifli , 2021, MSc, Investigation of passivation and gate insulator layer on GaN power devices.
5. Mohamad Hasnan Bin Abdull Hamid, 2020, MSc, Rapid Detection of COVID-19 Using AlGaIn/GaN High-Electron-Mobility Transistor (HEMT) Based Biosensor.

Graduated:

6. Nurul Athirah Binti Ali Yusup, MSc, Design and Fabrication of Electrodes For Drop Casting Method of Gold Nanoparticles On P-GaN, 2022
7. Shateri Aso Ali Abdalmoammed, MSc, Gallium Nitride Thin Film Gas Sensor, 2020
8. Khairul Bin Mohd Arshad, MSc, Fabrication of LED Packaging with Narrow Angle for Iris Scanning/ Recognition, 2020

## AFFILIATION

VISITING RESEARCHER, WASEDA  
UNIVERSITY, JAPAN

EUROPEAN MATERIAL RESEARCH  
SOCIETY (E-MRS)

MALAYSIAN SOLID STATE SCIENCE  
AND TECHNOLOGY (MASS)

SENSOR MALAYSIA

## Co-supervision

Active:

1. Mazwan Bin Mansor, 2022, PhD, Simulation of AlGa<sub>N</sub> based DUV-LED.
2. Siti Hajjar Binti Yahya, 2021, MSc, Fabrication and Characterisation of Copper Nitride Micro-disc Electrodes for the Detection of Dissolved Carbon Dioxide in Water Samples.
3. Islam Naeemul, 2021, MSc, Ga<sub>N</sub>-Based High Electron Mobility Transistor (HEMT) Power Device for Green Car Technology.
4. Mohd Nashaain Bin Nordin, 2019, PhD, Highly Selective and Sensitive Ammonium Sensors Based on AlGa<sub>N</sub>/Ga<sub>N</sub> High Electron Mobility Transistors.
5. Yusnizam Bin Yusuf, 2021, PhD, High Light Extraction Efficiency (LEE) of N-Polar Light Emitting Diodes (N-LEDS)

## RECOGNITION AND AWARDS

1. AWARD – SILVER MEDAL – 4th SIRIM Invention, Innovation & Technology Expo 2022 (SI2TE 2022), “AlGa<sub>N</sub>/Ga<sub>N</sub> high electron mobility transistor (HEMT) biosensor”, July 2022
2. AWARD – SILVER MEDAL – 4th SIRIM Invention, Innovation & Technology Expo 2022 (SI2TE 2022), “Novel packaging for 1 mm<sup>2</sup> high-powered Vertical-cavity surface emitting laser (VCSEL)”, July 2022
3. INVITED TALK - ASIASENSE 2021: 9th International Conference on Sensors, “COVID-19 Pandemic: How Semiconductor Technology Discoveries Can Combat Both Current and Future Pandemics”, Oct 2021
4. INVITED TALK - OLC International, NANOSCIENCE-NANOTECHNOLOGY-2021, “Wide band-gap semiconductor devices”, Nov 2021
5. INVITED JUDGE - International Eureka Innovation Exhibition 2021, i-EIE 2021, UniKL MSI
6. INVITED TALK - International Sciences, Technology and Engineering Conferences (ISTEC2020), “Power Devices: State-of-the-art and future prospects”, Oct 2020
7. EDITOR-IN-CHIEF - International Conference on Semiconductor Materials and Technology (ICoSeMT 2019), 2019
8. EDITOR - INTERNATIONAL JOURNAL OF NANOELECTRONICS AND MATERIALS (IJNeaM)
9. INVITED JUDGE - International Eureka Innovation Exhibition 2019, i-EIE 2019, UniKL MSI
10. INVITED JUDGE - Invention Competition, Conference and Exhibition (ICCE) V8 2019, Polytechnic Tuanku Sultanah Bahiyah, Oct 2019
11. INVITED TALK – “The End of Silicon Chips Era : The Future of Nano-devices”, Research Talk, INEE, UniMAP, May 2019
12. INTERNATIONAL INVITED TALK - “Diamond and Nitride Power Devices Future Crossover”, 13th New Diamond and Nano Carbon Conference (NDNC 2019), Hualien, Taiwan, May 2019
13. INTERNATIONAL INVITED TALK - “Exploring the potential of heteroepitaxial diamond as field effect transistor”, European Materials Research Fall Meeting (E-MRS 2018), Warszawa, Poland, Sept 2018
14. INVITED TALK – “High voltage diamond power devices for next generation power electronics applications”, Malaysian Nanotechnology Olympiad 2017, Malaysia, Oct 2017
15. INVITED JUDGE - “National Nanotechnology Innovations 2018 (PIN 18)”, MESTECC’s National Nanotechnology 2018
16. INTERNATIONAL RECOGNITION – Semiconductor Today Highlights (UK) “Black polycrystalline diamond transistors with high breakdown.” 25 Nov 2016.
17. AWARD – “WASEDA University Young Doctoral Scholarship Award”, 2014 - 2017
18. AWARD – “Best Dissertation Award 2010”, Malaysia Solid State Science and Technology (MASS)

## EXPERIENCE

1. **Postdoctoral Researcher**  
Kawarada Laboratory (川原田 洋 研究室),  
Faculty of Advanced Science and Engineering, Waseda University Japan [Oct 2017 – Oct 2018]
2. **Visiting Scientist**  
Kawarada Laboratory (川原田 洋 研究室),  
Faculty of Advanced Science and Engineering, Waseda University Japan [April 2017 - September 2017]
3. **Doctoral Researcher and Teaching Assistant**  
Kawarada Laboratory (川原田 洋 研究室),  
Faculty of Advanced Science and Engineering, Waseda University Japan [April 2014 - March 2017]
4. **Researcher,**  
SIRIM Berhad  
IC- Innovation in Nanotechnology [November 2010 - April 2018]

## CERTIFICATIONS

HUMAN RESOURCE DEVELOPMENT CORPORATION (HRD CORP) HRDF CERTIFIED TRAINER

MALAYSIA BOARD OF TECHNOLOGISTS (MBOT) GRADUATE TECHNOLOGIST

## RESEARCH ACTIVITIES

1. International Conference on Semiconductor Materials and Technology (ICoSeMT 2021), Penang, Malaysia, 8 – 9 November 2021, "Electrical Properties of GaN Cap Layer for AlGaN/GaN HEMT".
2. International Conference on Semiconductor Materials and Technology (ICoSeMT 2021), Penang, Malaysia, 8 – 9 November 2021, "Optimization of 1  $\mu$ m Gate Length InGaAs-InAlAs pHEMT".
3. International Conference on Semiconductor Materials and Technology (ICoSeMT 2021), Penang, Malaysia, 8 – 9 November 2021, "Effects of Notch Structures on the Transfer and DC Performances of AlGaN/GaN HEMT Devices".
4. International Conference on Semiconductor Materials and Technology (ICoSeMT 2021), Penang, Malaysia, 8 – 9 November 2021, "Comparison of the Electrical Performance of AlN and HfO2 Passivation Layer in AlGaN/GaN HEMT".
5. International Conference on Semiconductor Materials and Technology (ICoSeMT 2021), Penang, Malaysia, 8 – 9 November 2021, "Modelling and Thermal Simulation for 1mm<sup>2</sup> VSCSEL Chip".
6. International Conference on Semiconductor Materials and Technology (ICoSeMT 2021), Penang, Malaysia, 8 – 9 November 2021, "Nanomanipulation of Functionalized Gold Nanoparticles on GaN".
7. 2020 4th IEEE Electron Devices Technology & Manufacturing Conference (EDTM), Penang, Malaysia, 6 – 20 April 2020. "Reliability of 2DHG Diamond FET by Harsh-Continuous Stress Voltage Approach".
8. International Conference on Semiconductor Materials and Technology (ICoSeMT 2019), Penang, Malaysia, 29 -30 April 2019."Diamond as Power Device".
9. International Conference on New Diamond and Nano Carbons. NDNC 2018. Flagstaff, Arizona, 20 May – 24 May 2018."Solution Giant Gate Graphene FET (SG3FET) pH Sensor."
10. MRS Fall Meeting & Exhibit 2017 (MRS 2017), Massachusetts, United States of America. Nov. 26-Dec. 1, 2017"Device Simulation of Several C-H MOSFETs Diamond Substrates via Two-Dimensional Negatively Charged Sheet Model"
11. International Conference on New Diamond and Nano Carbons. NDNC 2017. Cairns, Australia, 28 May – 1 June 2017."Heteroepitaxial diamond field effect transistor for high voltage applications."
12. International Conference on Solid State Devices and Materials, Tsukuba, Japan. 26-29 September, 2016."Planer Diamond P-channel MOSFETs with Breakdown Voltage  $V_B > 1.8$ kV and High Drain Current Density by 2DHG"
13. International Conference on Diamond and Carbon Materials 2016 (DCM 2016), Montpellier, France. 28 May – 1 June 2016."High endurance transparent polycrystalline diamond FET for power electronics application"
14. Nano Korea 2016, Gyeonggi-do, South Korea. 13 – 15 July 2016. "Cost effective white polycrystalline diamond FET using 2D hole gas"
15. MRS Fall Meeting & Exhibit 2015 (MRS 2015), Massachusetts, United States of America. Nov. 29-Dec. 4, 2015. "High Voltage Breakdown 1.8 kV Hydrogenated Black Diamond Field Effect Transistor"
16. Japan Society of Applied Physics, 76th Autumn Meeting 2015, (JSAP 2015), Nagoya, Japan. 13-16 September 2015."Hydrogenated Black Diamond FET with high voltage breakdown of 1.8kV"
17. MRS Fall Meeting & Exhibit 2014 (MRS 2014), Massachusetts, United States of America. Nov. 30-Dec. 5, 2014"Fabrication of Diamond Rods for Power Device Application"
18. International Conference on Nanotechnology 2011 (ICONTECH 2011), Malaysia. 6-9 June 2011.
19. International Conference on Enabling Science and Nanotechnology 2010 (ESCI 2010), Malaysia. 1 -3 December 2010."Dispersion and Integration of SWNT for Carbon Nanotube based biosensor"
20. International Conference on Solid State Science and Technology 2010 (ICSST 2010), Malaysia. 1-3 November 2010."Optimization of Carbon Nanotube based biosensor for medical diagnostics application"
21. International Postgraduate Conference 2010 (IPCE 2010), Malaysia. 16-17 October 2010."Development of Carbon Nanotube based Biosensor"
22. International Workshop and Conference on Nanotechnology 2010 (IWCN 2010), Malaysia. 25 – 27 January 2010."Development of Carbon Nanotube based biosensor design"
23. IEEE Regional Symposium on Micro and Nanoelectronics 2009, Malaysia. 10-12 August 2009. "Comparison of MOS Capacitor using TCAD"

## TEACHING EXPERIENCE

1. INE504/4, 2022, Advanced Optoelectronics
2. INE504/4, 2021, Advanced Optoelectronics
3. KAA500/3, 2021, Research Methodology
4. INE504/4, 2020, Advanced Optoelectronics
5. INE504/4, 2019, Advanced Optoelectronics