

National Applied R&D Centre



# NANO CONDUCTIVE INKS

AIMAN SAJIDAH ABD AZIZ

Head of Advanced Materials, Semiconductor R&D Division

*Innovation for Life™*

X f @ You Tube in  
mimosmalaysia



[www.mimos.my](http://www.mimos.my)



# MIMOS Berhad

A strategic agency under the **Ministry of Science, Technology and Innovation (MOSTI)**, responsible for raising Malaysia's industry competitiveness through exploitable IP & technologies, products and solutions

## Our Vision

To be applied research centre in frontier technologies

## Our Mission

To pioneer innovative technologies towards growing globally-competitive homegrown industry

### Our R&D

As a centre of research excellence, MIMOS R&D activities currently focus on **Semiconductors & Thin Film Research, Embedded Microelectronics, and Technologies for Manufacturing and Smart Nation.**



### Our Services

MIMOS manages world-class national technology facilities equipped with state-of-the-art machinery providing technical expertise and consultancy services to the industry.



# Locations, Stakeholders, Human Capital & IP's

## Main: Technology Park Malaysia Campus



## Branch: Kulim Hi-Tech Park Campus

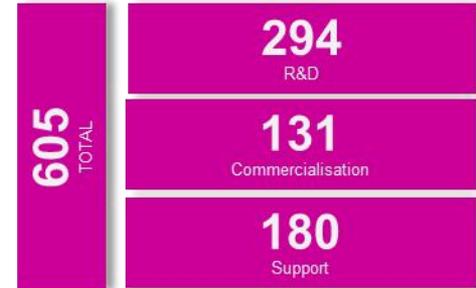


## Stakeholders



- Government of Malaysia
- Higher Learning Institutions
- Industry – E&E, ICT
- Partners & Collaborators
- Research Institutions
- SMEs
- Public

## Human Capital



## Intellectual Properties



# NANO CONDUCTIVE INK

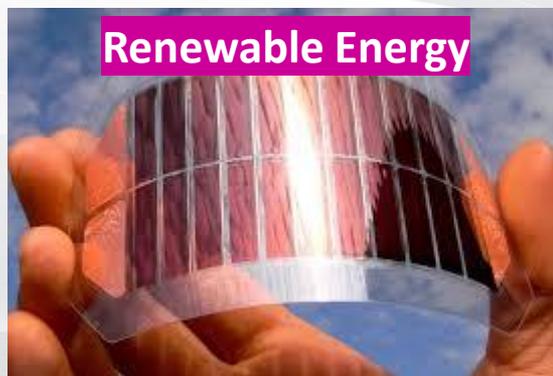
## Graphene Conductive Ink – Silver Conductive Ink

Tailored for flexible and lightweight electronic components, enables rapid prototyping and high-throughput manufacturing of smart packaging, RFID antennas, sensors, and wearable devices.



# FROM RIGID TO FLEXIBLE ELECTRONICS

## The Shift Towards Printed Electronics in Modern Applications



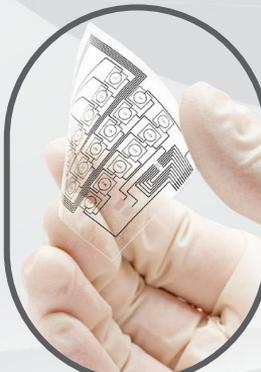
### Features

#### Flexible



**Flexible electronics** is a significant driver of Printed Electronics (PE) industry. The transformative impact of PE enabling experimentation with various ink materials and functionalities on **diverse substrate materials**.

#### Light-weight



Printed flexible electronics are much thinner and lighter than conventional PCBs and silicon-based components, making **them ideal for wearable devices, IoT applications, and mobile electronics**.

#### Low-cost



Printing-based manufacturing techniques (e.g., inkjet printing, screen printing, roll-to-roll printing) allow for low-cost, high-volume production, **reducing the need for expensive lithography and vacuum-based processes**.

# Products: Nano Conductive inks



## GraphPrnk

A graphene-based conductive ink with water-based formulation as a substitute for metal-based conductive ink. It is fast-drying and eco-friendly and supports flexible printed electronics and wearable sensors and devices.



## AgPrnk

A silver-based conductive ink with innovative water-based formulation, rapid drying and oxidation-resistant. It is compatible with the inkjet printing process and supports flexible printed electronics and wearable sensors and devices.

### Target segment & end applications

- RFID
- IOT
- Sensors
- Low cost electronics
- Solar cell electrodes

### Current & potential customers

- Universities / research institutes
- Electronic materials chemical manufacturer
- Start-up company
- Customisation electronics (POC) manufacturer



# NANO CONDUCTIVE INK

These high-conductivity specialty inks are designed for inkjet printing on diverse plastic substrates  
**enabling the scalable fabrication of next-generation electronic devices.**



Water-based Environmental Formulation



Room Temperature Storage



Nanoengineered Advanced Material



Additive Manufacturing



Rapid Curing in Seconds



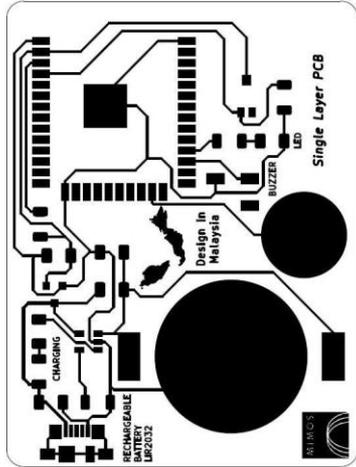
# # 9



### Certification & Verification:



# Print Electronics Like Never Before: Inkjet Technology At Your Fingertips



**Design  
(Digital, No mask)**



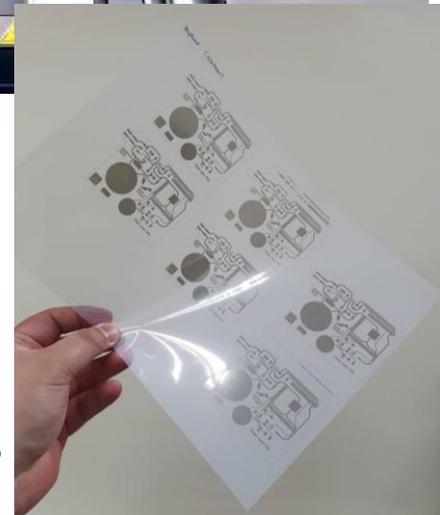
**Nano conductive Ink**



**Inkjet Printing**



**Conductive Printed  
Patterns**





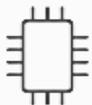
# Product Benchmarking

Characteristics	 Silver ink	 Ag Nano ink IJ36	 Inkjet silver conductor PE410	 Silver nanoparticle EMD5730 (901971)	 Nano silver inkjet ink S-CS01520 (923567)
▪ <b>Origin</b>	Malaysia	USA	USA	USA	USA/Malaysia
▪ <b>Silver content (%)</b>	<b>10±2</b>	34±2	45.2	39 - 41	10 - 30
▪ <b>Density</b>	1.04 – 1.06	1.24 – 1.4	N/A	1.427	1.13
▪ <b>Viscosity</b>	<10	26 – 30	20 - 40	11 – 13	12
▪ <b>Nanoparticle size (nm)</b>	<b>61 – 87 [DLS] 20±6 [TEM]</b>	80 – 105 [DLS] 35 – 50 [TEM]	N/A	N/A	N/A
▪ <b>Electrical resistivity (μΩ.cm)</b>	39.65 [1μm] at 40 °C	3.95 >1μm	500 at 130 °C	Conductive at 150 - 200 °C	6.6 at 150° C ?μm
▪ <b>Flash point (°C)</b>	<b>92.4</b>	N/A	N/A	22	60
▪ <b>Surface tension (mN/m)</b>	<b>30 – 60 * custom</b>	30	N/A	28 - 31	24
▪ <b>Solvent</b>	<b>Water</b>	Glycol ether	Solvent-based	Solvent-based	Alcohol
▪ <b>Drying</b>	<b>40 °C</b>	N/A	130-150 °C, 20min	150–200 °C	150-200°C
▪ <b>Storage</b>	<b>Room temperature</b>	4-6 °C	2-8 °C	2-8 °C	2-8 °C
▪ <b>Shelf-life (months)</b>	<b>12</b>	3	3	N/A	N/A

# Application & Use Cases

## Printed Circuits

Enables rapid prototyping of printed circuit boards.



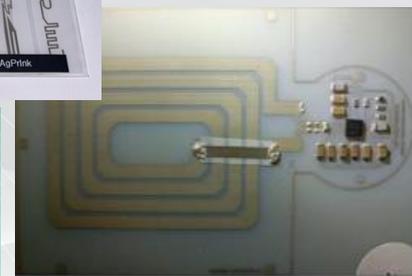
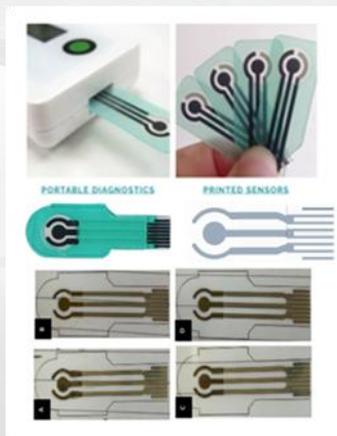
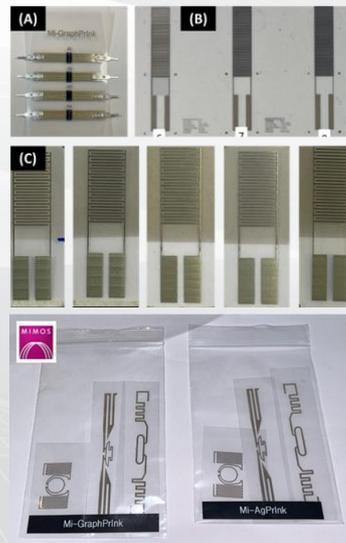
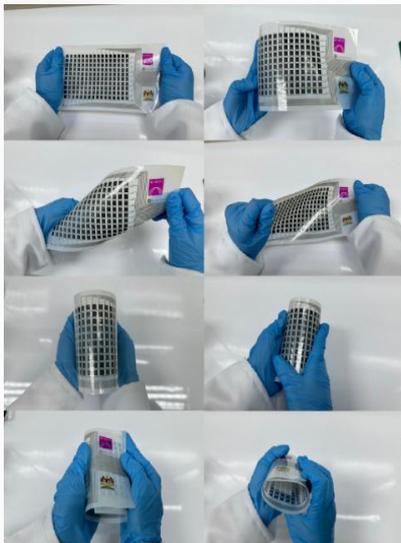
## RFID Tags

Essential for wireless communication and tracking.



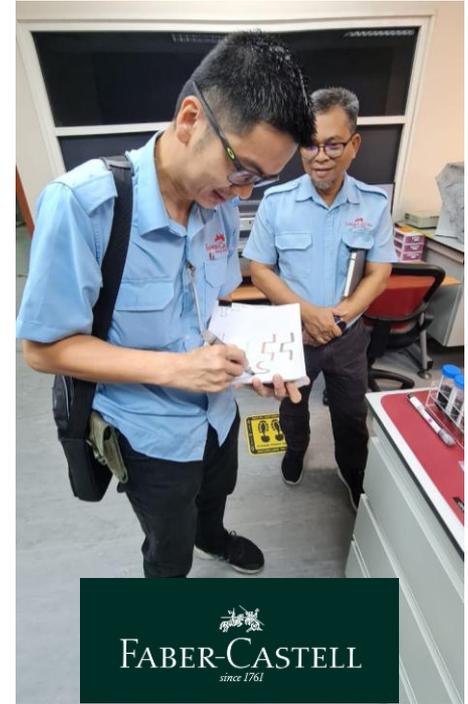
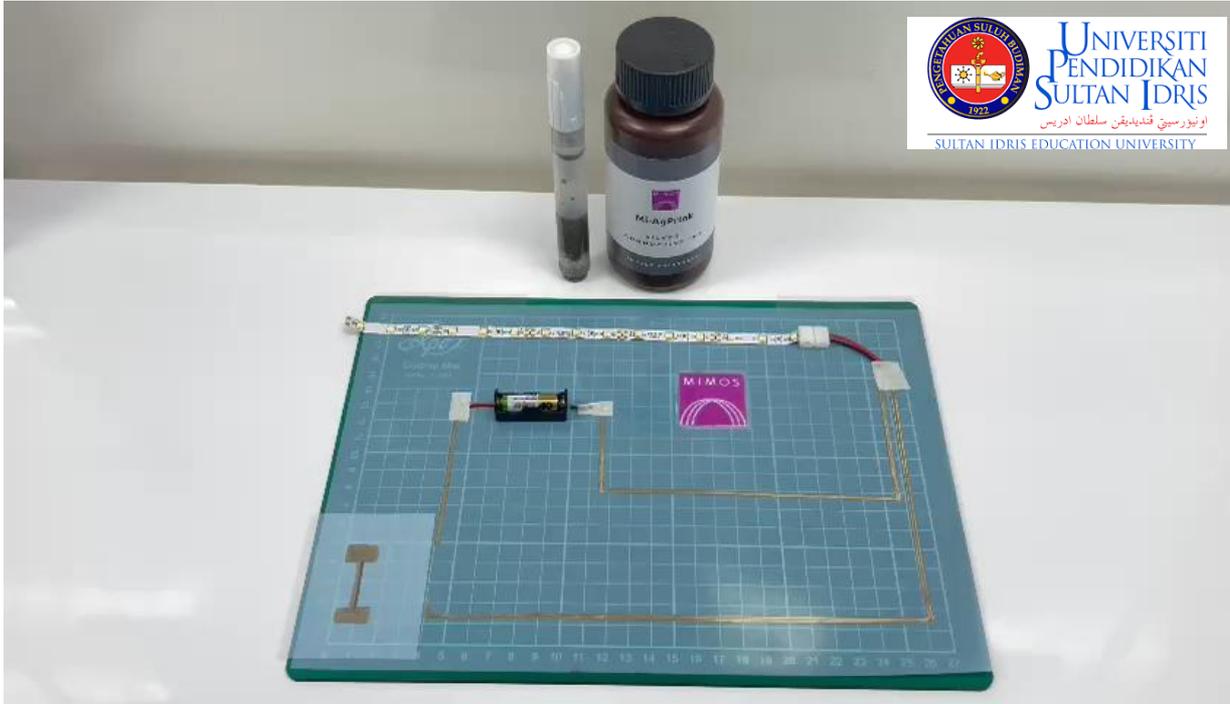
## Flexible Sensors

Used in smart textiles and IoT devices.





# Science, Technology, Engineering & Math (STEM)



Visit by  
Faber-Castell (M) Sdn Bhd

# Conductive Ink Market Size & Opportunity

USD **342M** (2030)

**Global Flexible Hybrid Electronic**

USD **71.5M** (2030)

**APAC Flexible Hybrid Electronic**

USD **21.5M** (est, 2030)

**Local Flexible hybrid Electronic**

DuPont; Vorbeck Materials Corp.; Applied Nanotech Holdings, Inc.; Sun Chemical Corporation; PPG Industries, Inc.; Creative Materials, Inc.; Poly-Ink; Henkel Ag & Co. KGaA; PChem Associates, Inc.; Johnson Matthey Colour Technologies; Fujikura Ltd.; Heraeus Holding; Nagase America Corporation; Engineered Materials Systems

DuPont de Nemours, Inc; Henkel AG & Co. KGaA; Heraeus Holding GmbH; MERCK KGaA; InkTec; NovaCentrix; Inkroy Oy; and Molex, LLC (Koch Industries, Inc.)

Malaysia Chemical Company :  
 Penchem Technologies Sdn Bhd ,  
 Graphene NanoChem PLC , Ugent Tech Sdn Bhd ,  
 GO Advanced Technology Sdn Bhd ,  
 Graphene Nanochem Sdn Bhd , Lintess  
 Technologies Sdn Bhd

## Opportunities :

1. IDTechEx estimates the current conductive ink market size as \$2.3 billion (2021) Almost 80% is silver flake-based ink that is used to make the conductive fingers on silicon solar panels. While the market for this application established and may even decline in future as new technologies are adopted, there is extensive growth in flake-based inks for other applications, and also in emerging categories of conductive inks such as nanoparticle-based and particle-free inks.
2. [The global conductive ink market for 2020](#) ( Verified Market Research) stood at USD\$2.91 billion and is expected to grow at a CAGR of around 4% until year 2028, reaching a market value of USD\$3.98 billion.
3. Flexible hybrid electronics (FHE) is another exciting opportunity for conductive ink, since it will enable printed inks to be utilized within circuits that combine mounted components with printed conductive traces, and thus can replace PCBs for applications where flexibility and lightweight are important



# Commercialisation in Malaysia

**DuitNow / Transfer Money Acknowledgement**

Successful Ref 61489947 13 Jul 2024, 10:37:59 am

To: Account Number: 514413402358 Amount: MYR 3,240.00  
 Recipient Name: MIMOS SEMICONDUCTOR Bank Name: Maybank  
 Transfer Type: To Other Banks or E-Wallet Payment Type: Fund Transfer  
 Transfer Method: DuitNow to Account (Instant Transfer)

**CIMB ISLAMIC CIMB BANK**

**PAYMENT ADVISE**

CIMB Reference No.: 202410225393198100  
 Customer Reference No.: PIV0561  
 Date: 22/10/2024  
 To: MIMOS SEMICONDUCTOR (M) SDN BHD

Dear Sir / Madam,  
 We have received a request from COLLABORATIVE RESEARCH IN ENGINEERING, to credit the amount of MYR 8,480.00 to your account with MALAYAN BANKING BHD (account number: \*\*\*\*\*2358) on 22/10/2024

Please contact COLLABORATIVE RESEARCH IN ENGINEERING, if you do not receive the payment on time.  
 (Details below are provided by COLLABORATIVE RESEARCH IN ENGINEERING.)

**UNIVERSITY OF Southampton MALAYSIA**

Order Contact:  
 Nurayunisa Binti Othman  
 No. 3 Persiaran Canselor 1, Kota Ilmu Ed  
 78200 Newsley, Jajah,  
 Johor  
 E-mail: rbo1g14@soton.ac.uk

**Purchase Order**

MIMOS SEMICONDUCTOR (M) SDN BHD  
 NANO CHARACTERIZATION & QRA  
 SERVICES LA  
 B, TECHNOLOGY PARK MALAYSIA,  
 KUALA LUMPUR  
 67000  
 Malaysia  
 email:  
 Delivery  
 CO302,  
 Blok C Eko Galleria,  
 Jalan Eko Botani 3,  
 Taman Eko Botani,  
 79100 Iskandar Puteri  
 Johor  
 Island Ptd

Order No.: 60017630

Invoice To:  
 CO302,  
 Blok C Eko Galleria,  
 Jalan Eko Botani 3,  
 79100 Iskandar Puteri  
 Johor, Malaysia  
 Tel : +607 5602360

PRODUCT	DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT (MYR)
	Inkjet Printable Conductive Ink (M-AgInks) - 1 bottle, 25mL.	1.00	UK	3,848.80	
	Inkjet Printable Conductive Ink (M-CrAgInks) - 1 bottle, 25mL.	1.00	UK	3,848.80	3,848.80

**NANO COMMERCE SDN BHD** (101474-W)  
 LEVEL 21-02, SUNWAY PUTRA TOWER,  
 100, JALAN PUTRA,  
 50300, KUALA LUMPUR  
 Tel: +603-2779 0200, Fax: +603-4501 3827  
 GST ID No: 01912311200

**PURCHASE ORDER** No.: PO-24080081

MIMOS SEMICONDUCTOR (M) SDN BHD  
 TAMAN TEKNOLOGI MALAYSIA  
 LEBUHRAYA PUCHONG-SG BESI  
 BUKIT JALIL, 57000  
 KUALA LUMPUR  
 TEL : 09-69595642

Your Ref No.: MSS8-0450-2024 RV1  
 Terms: 30 DAYS  
 Date: 28/08/2024  
 Page: 1 of 1

Item	Description	UOM	Qty	U/ Price	Disc.	Total RM
1.	R-2400 1. Inkjet Printing service on PET substrate- 5 design variations, 20 days		1	5,640.00		5,640.00
2.	Inkjet Printed Conductive Ink- 25mL/bottle		6	3,560.00		21,360.00
3.	SST Charges 8%		1	2,160.00		2,160.00

**SALES**  
 ~RM 80,000 ~ 1 Mil  
 PHP

**ISBC**

Advised sending date: 31 Aug 2024  
 Advice reference no: A28994312  
 Page: 8/8

Payment Advise

Beneficiary's name and contact information:  
 Ms. Ayu Gribana  
 P.O. Box 888888  
 8, Jalan Semarak  
 50488 Kuala Lumpur  
 Malaysia  
 Tel: +603-2333 3333  
 Fax: +603-2333 3333  
 Email: ayugribana@isbc.com.my

Beneficiary's bank:  
 MIMOS SEMICONDUCTOR (M) SDN BHD  
 TAMAN TEKNOLOGI MALAYSIA  
 LEBUHRAYA PUCHONG-SG BESI  
 BUKIT JALIL, 57000  
 KUALA LUMPUR  
 MALAYSIA  
 Tel: +603-69595642  
 Fax: +603-69595642  
 Email: info@mimos.com.my

Debit account:  
 MIMOS SEMICONDUCTOR (M) SDN BHD  
 TAMAN TEKNOLOGI MALAYSIA  
 LEBUHRAYA PUCHONG-SG BESI  
 BUKIT JALIL, 57000  
 KUALA LUMPUR  
 MALAYSIA  
 Tel: +603-69595642  
 Fax: +603-69595642  
 Email: info@mimos.com.my

Beneficiary's account:  
 MALAYAN BANKING BHD (MAYBANK)  
 (part of the account number is shown as \*\*\*\*\*) for security reasons  
 Other reference:  
 MIMOS SEMICONDUCTOR (M) SDN BHD

Letter to beneficiary information:  
 (MIMOS)





# Partners & Customers





## Call to Action

We're seeking **innovators/collaborators, industry partners, investors, or government support** to:

- 1) Introduce **nano-conductive inks into the Philippine market** through **technology licensing**
- 2) Co-develop product variants (UV inks, screen-printable paste, hybrid inks) through **partnership & joint R&D**
- 3) Collaborate on new application development for **proof-of-concept** through **R&D collaboration and grants**



# MEET THE TEAM



***From Left: Linda, Dr. Siti, Adzmir, Dr. Syed, Suhairi, Aiman, Zuulaika, Hazierah, Dr. Hidayah, Nora'zah, Dr. Faizol & Suraya (not on the picture)***

National Applied R&D Centre



# THANK YOU

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