

# SunSens Electronic Materials for Biosensors

*Experience. Transformation.*

**SunChemical®**

a member of the DIC group



## SunSens for Biosensors

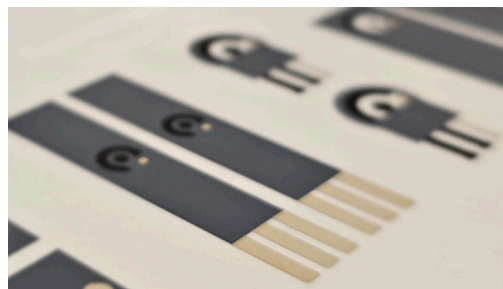
SunSens portfolio of functional inks is suitable for a range of biosensor systems, that can be used in electrochemical sensors for medical, agricultural and environmental monitoring.

The range of applications extends to medical and wearable electrodes; for health and wellbeing monitoring, as well as cosmetic.

SunSens products are suitable for screen printing. Materials for alternative printing processes or custom formulations are available via consultation or contract development.

The following material classes are included in the SunSens portfolio:

- Gold Electrode Materials
- Platinum Electrode Materials
- Carbons for Working/Counter Electrode materials
- Mediated Carbons for Working Electrode materials
- Silver & Silver-Silver Chloride Pastes for Reference/Counter Electrode materials
- Insulators & Cover Coat Materials and Cobalt Phthalocyanine



## Platinum Electrode Materials

Platinum electrode materials from Sun Chemical are available in cross linked polymeric, standard polymeric, and high temperature varieties. Optimized for both high and low temperature substrates, Sun Chemical's platinum electrode materials are engineered for a range of electrochemical sensors and biosensors.

Paste Type	Product Code	Compatible Substrates	Primary Applications/Benefits	Normalized Sheet Resistance (Dry Film Thickness)
Cross-Linking Low Temperature Platinum	C2020322P6	PET, PVC, PC or ceramic	Used for printing working electrodes in low temperature electro-chemical sensor applications. It can also be used as a counter electrode. Used to electrochemically measure hydrogen peroxide, and can be coupled to produce biosensors, with oxidase enzymes, DNA or immunosensors.	≤ 320 mΩ/square at 25 μm
Low Temperature Platinum	C2050804P9	PET, ceramics, Kapton, etc.	Platinum Paste is a screen printable paste designed for low temperature printing working electrodes in electrochemical sensor applications. It can also be used as counter electrodes. The paste is designed for curing on polymeric substrates.	≤ 1.85 Ω/square at 25 μm
High Temperature Platinum	C51002P6	96% Alumina and ceramic	Used for firing at high temperatures on ceramic substrates. Used as a screen printable paste designed for printing high temperature working electrodes in electrochemical sensor applications. It can also be used as counter electrodes.	≤ 320 mΩ/square at 25 μm

## Gold Electrode Materials

Sun Chemical has a range of gold electrode pastes developed for electrochemical sensors and biosensors which can be used for self-assembled monolayers in enzymatic biosensors, and are also suitable for all forms of electrochemistry. Gold electrode materials from Sun Chemical are also ideal for immunosensors and are available in low and high temperature formulations with higher conductivity.

Paste Type	Product Code	Compatible Substrates	Primary Applications/Benefits	Normalized Sheet Resistance (Dry Film Thickness)
Low Temperature Gold	C2041206P2	PET, PVC, PC or ceramic	This is a screen printable gold polymer paste designed to provide excellent electrochemical performance in biosensor working electrodes. This is used in Medical Diagnostics, Environmental Sensor and the Agri-Food Industries. Cured at 80 °C for 30 minutes. Highly compatible with our counter and reference electrodes materials. Suitable for Self-assembled monolayers, DNA and Immunosensors.	≤ 80 mΩ/square at 25 μm
High Temperature Gold	C2090908D1	96% Alumina and ceramic	A screen printable gold paste designed for printing high definition electrodes in sensor applications. Fired at 700 °C for 30 minutes this is designed to provide high definition electrodes. Designed to remove all polymeric residues from the surface and to provide a very thin layer of highly conductive gold layer, excellent electrochemical performance. The paste is designed for firing at high temperatures to ceramic substrates.	≤ 4 Ω/square at 25 μm

## Carbon Electrode Materials

Working electrode materials from Sun Chemical are optimized for use on various flexible and rigid substrates, including alumina, PET, PVC, and more.

Paste Type	Product Code	Compatible Substrates	Primary Applications/Benefits	Normalized Sheet Resistance (Dry Film Thickness)
Carbon/Graphite	C2030519P4	Alumina, PET, PVC, Valox FR1	Used in mass production of glucose biosensors producing good printed line definition and ideal for electrochemical applications. Good reversible cyclic voltammetric properties with Ferricyanide mediator. Used in conjunction with UV dielectrics and heat cure dielectrics.	$\leq 60 \Omega/\text{square}$ at 25 $\mu\text{m}$
Carbon/Graphite	C2180626D6	PET, PVC, PC or ceramic	A quicker drying version of C2030519P4.	$\leq 50 \Omega/\text{square}$ at 25 $\mu\text{m}$
Graphene/Carbon	C2180313D1	PET, polyester, polycarbonate, Kapton or ceramic	Used in bacteria biosensors. Excellent electrochemical performance with good reversibility when using cyclic voltammetry.	$\leq 20 \Omega/\text{square}$ at 25 $\mu\text{m}$
Graphene/Carbon	C2171023D1	PET, PBT, PVC, or ceramic	Used as a screen printable conductive paste for use in a variety of applications, including conductive tracks and biosensors. Provides high conductivity to sensors and biosensors.	$\leq 10 \Omega/\text{square}$ at 25 $\mu\text{m}$
Carbon/Graphite	C2130814D2	PET, PVC or ceramic	Used as a screen printable conductive paste for mass production of blood glucose biosensors. Highly conductive, provides tough, scratch resistant printed films. Provides good flexibility and adhesion. Good impedance results from 100 kHz to 500 Hz.	$\leq 10 \Omega/\text{square}$ at 25 $\mu\text{m}$
Carbon/Graphite	C2170411D1	PET, PVC or ceramic	Used as a screen printable conductive paste for mass production of blood glucose biosensors. Highly conductive and provides tough, scratch resistant printed films. Provides good flexibility and adhesion. Grades available for different resin types and viscosities. Good impedance results from 100 kHz to 500 Hz.	$\leq 10 \Omega/\text{square}$ at 25 $\mu\text{m}$
Carbon	C2090225D3	Alumina, PET, PVC, Valox FR1	Low-cost carbon graphite ink used in 2-reference electrodes of mass printed blood sugar glucose strips.	$\leq 80 \Omega/\text{square}$ at 25 $\mu\text{m}$

## Mediated Carbon Electrode Materials

Mediated working electrode materials from Sun Chemical are optimized for use on various flexible and ridged substrates, including alumina, PET, PVC, and more. Available in tailor made formulations, for enzyme-based technology, are ideal for reactions involving NADH and hydrogen peroxide.

Paste Type	Product Code	Compatible Substrates	Primary Applications/Benefits	Normalized Sheet Resistance (Dry Film Thickness)
Cobalt Phthalocyanine Mediated Carbon Graphite Paste	C2030408P3	PET, PVC, PC or ceramic	Used for screen printing working electrodes. This is a carbon/graphite paste which has been optimized to give superior electrochemical performance and contains Cobalt Phthalocyanine as mediator that makes it suitable for use with oxidase enzymes where hydrogen peroxide is generated and detected.	$\leq 60 \Omega/\text{square}$ at 25 $\mu\text{m}$
Prussian Blue Mediated Carbon Graphite Paste	C2070424P2	PET, PVC, PC or ceramic	Used for screen printing working electrodes. These electrodes, when used in conjunction with specific oxidase type enzymes, enable the detection of many analytes.	$\leq 65 \Omega/\text{square}$ at 25 $\mu\text{m}$
Potassium Ferrocyanide Mediated Carbon Graphite Paste	C2070508P4	PET, PVC, PC or ceramic	Used for screen printing working electrodes. These electrodes when used in conjunction with specific oxidase type enzymes, enable the detection of many analytes, especially with Horseradish Peroxidase for hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) detection.	$\leq 60 \Omega/\text{square}$ at 25 $\mu\text{m}$

## Reference / Counter Electrode Materials and Silvers for Underprinting

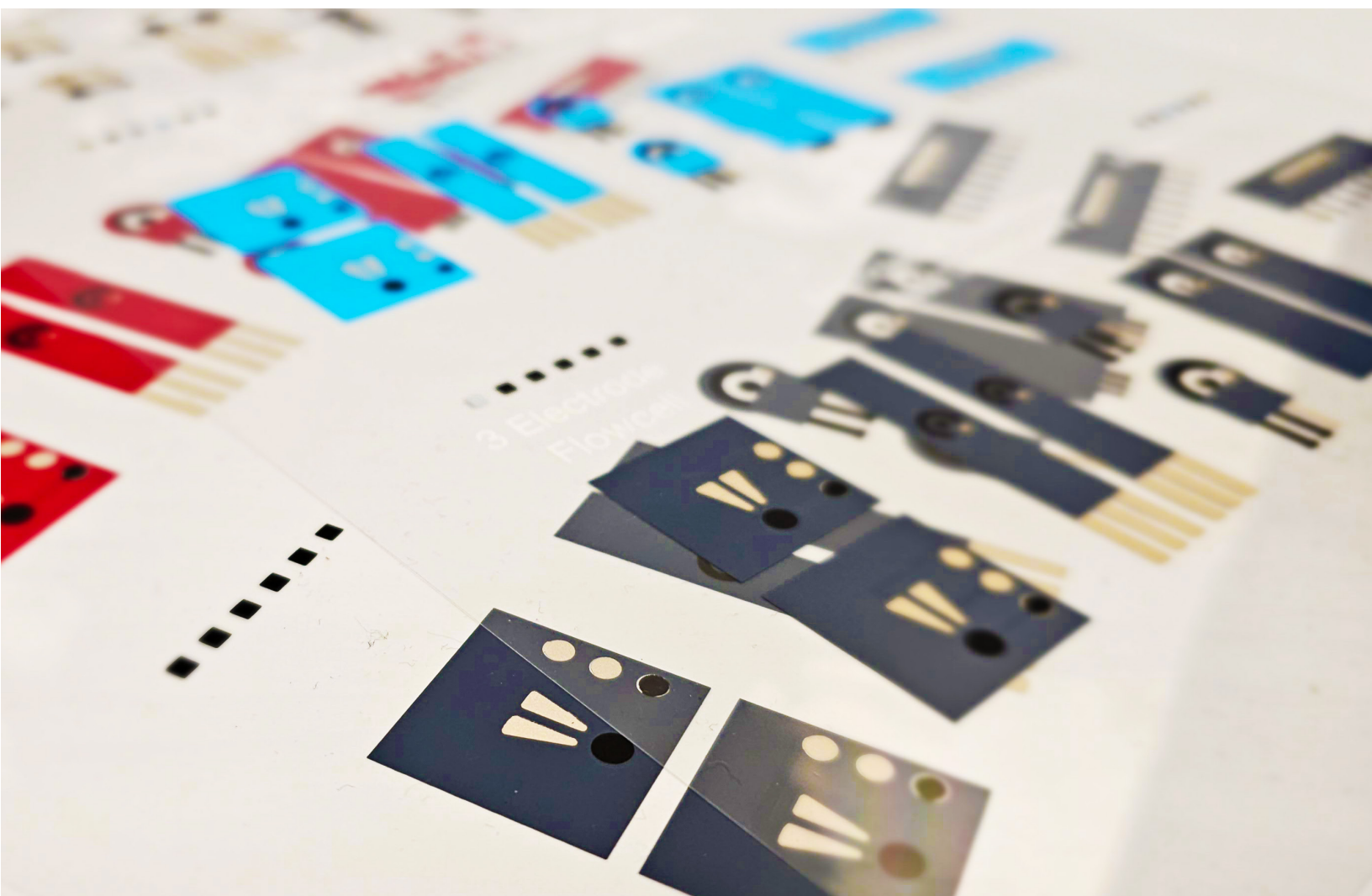
Sun Chemical is the leading provider of Silver/Silver Chloride inks. Batches up to 500 kg can be produced providing a consistent product with stable linear electrochemical response. Silver/Silver Chloride can be manufactured as thermoplastic or thermoset inks with Ag to AgCl ratios varying from 40:60 to 90:10. Silver underprint inks are available which can lower the resistance of carbon working electrodes if specific electrode designs cause high resistance tracks.

Paste Type	Product Code	Compatible Substrates	Product Benefits	Primary Applications	Normalized Sheet Resistance (Dry Film Thickness)
Ag	C2080415P2	Polyimide, PET, PEN, FR4, ITO, Alumina	Low cost silver ink, suitable for flexible conductive tracks, underprints and counter electrodes. It is currently used in mass production of glucose biosensor tracks and also to print underneath carbon graphite inks to enhance conductivity.	Used in medical circuitry for interconnects, conductive tracks, underprints and counter electrodes	≤ 60 mΩ/square at 25 μm
Ag	C2120918P1	Polyimide, PET, PEN, FR4, ITO, Alumina	Used in mass produced rotary screen printed biosensors with excellent adhesion, conductivity and print properties. Fast evaporating solvents.		≤ 20 mΩ/square at 25 μm
Ag	C2180423D2	Polyimide, PET, PEN, FR4, ITO, Alumina	Designed to provide maximum flexibility in flexible biosensors in addition to our stretch and crease package. This product is also suitable for in-mold electronics.		≤ 30 mΩ/square at 25μm
AgC	C2181108D2	Polyimide, PET, PEN, FR4, ITO, Alumina	Blended with carbon to provide a low silver content, low resistance and a good adhesion with polymeric substrates. Low temperature and fast curing.		≤ 100 mΩ/square at 25μm
Ag	C2050926P2	Ceramic	Designed for high temperature curing onto ceramic substrates to print interconnects and counter electrodes for medical sensors.		≤ 3m Ω/25μm DFT
Ag/AgCl (40:60)	C2040308P2	PET, PVC, PC, Polyimide, PET, PEN, FR4, ITO, Alumina	Applications in Medical Diagnostics, Environmental Sensors and the 'Agri-Food' Industries. Good print definition.	Medical sensors, biosensors, EKG/ ECG, EEG and Environmental Sensors. DNA Sensors & Lab on a Chip	≤ 5 Ω/square at 25μm
Ag/AgCl (50:50)	C2131007D3		Ratio of Silver to Silver Chloride of 50/50 with good reference electrode properties. The paste is in a ready to use form at a viscosity suitable for automatic or semi-automatic screen printing.		≤ 100 mΩ/square at 25μm
Ag/AgCl (60:40)	C2130809D5		Excellent adhesion, conductivity and electrochemical performance. Popular reference electrode used in standard electrochemical base transducers.		≤ 100 mΩ/square at 25μm
Ag/AgCl (60:40)	C61003P7		Excellent adhesion, conductivity and electrochemical performance.		≤ 3Ω/square at 25 μm
Ag/AgCl (60:40)	C2180730D1		Used for continuous glucose monitoring. Excellent adhesion, conductivity and electrochemical performance.		≤ 3.5Ω/square at 25 μm
Ag/AgCl (70:30)	C2090225P7		A slower drying version of C2130102D1 with good reference electrode properties.		≤ 500 mΩ/square at 25 μm
Ag/AgCl (70:30)	C2130102D1		Ratio of Silver to Silver Chloride of 70/30 with a reduced particle size so capable of fine-line printing.		≤ 700 mΩ/square at 25 μm
Ag/AgCl (80:20)	C2130429D3		Ratio of Silver to Silver Chloride of 80/20 with good reference electrode properties.		≤ 40 mΩ/square at 25 μm
Ag/AgCl (80:20)	C2140310D1		Ratio of Silver to Silver Chloride of 80/20 developed to have an improved wetting and contact angle compared to C2130429D3.		≤ 40 mΩ/square at 25 μm
Ag/AgCl (90:10)	C2000218P5		Ratio of Silver to Silver Chloride of 90/10 specifically designed for ceramic substrates. Good reference electrode properties and 9 months of shelf life.		≤ 200 mΩ/square at 25 μm
Ag/AgCl (90:10)	C60531P1	PET, PVC, PC or Ceramic	Designed to provide excellent mechanical response for CGM (Continuous Glucose Monitoring) biosensors used in ICU Intensive Care Units	Medical sensors, biosensors	≤ 150 mΩ/square at 13 μm
Ag/AgCl/Carbon Graphite	C2190312D1	Alumina, PET, PVC, Valox FR1	Low cost Ag/AgCl formulation blended with Carbon/Graphite, designed specifically for medical devices that require low cost and high performing reference electrodes.	Sensors, Biosensors and EEG, ECG/EKG market.	≤ 3 Ω/square at 25 μm

## Insulation or Cover Coat Materials

Dielectric / Insulation Electrode Materials from Sun Chemical can be used to define the working electrode area or to isolate conductive tracks. SunSens insulation or cover coat materials minimize the pin-holing effect.

Paste Type	Product Code	Compatible Substrates	Primary Applications	Additional Notes	Product Benefits
Cross-Linking White Dielectric	D2070209P6	PET, PVC, PC or ceramic	Designed specifically for use in normal screen printing or rotary screen-printed Biosensors and Electro Luminescent systems.	White	Excellent adhesion, chemical and environmental resistance.
Grey Dielectric	D2070423P5	PET, PVC, PC or ceramic	Suitable for defining electrode areas and forms a protective layer over the electrode tracking during immersion of the electrode.	Grey	The formulation is designed for maximum flexibility.
Cross-Linking White Dielectric	D2100824D2	PET, PVC, PC or ceramic	Designed for use in electrochemical biosensors and other printed electronics Epoxy based high Dielectric constant white over coat. Ideal for large printing areas.	White	Excellent Opacity, excellent Insulation, and long screen life.
Cross-Linking White Dielectric	D2130510P2	PET, PVC, PC or ceramic	Designed for use in electrochemical biosensors and other printed electronics. Epoxy based high hiding power white over coat.	White	Excellent Opacity, excellent Insulation, and long screen life.
White Dielectric	D2171220D2	PET, PVC, PC or ceramic	Suitable for defining electrode areas and forms a protective layer over the electrode tracking during immersion of the electrode. Used in CGM's.	White	The formulation is designed for maximum flexibility. This paste is hydrophilic in nature.
Blue Polymer Dielectric	D50706P3	PET, PVC, PC or ceramic	Solvent-resistant dielectric suitable for defining electrode areas and forms a protective layer over the electrode tracking during immersion of the electrode.	Blue	This product offers resistance to most solvent attack.



# Experience. *Transformation.*

## A partner who transforms with you.

Today's environment requires more than change. It demands transformation — and a partner who's willing to transform with you. Sun Chemical, a member of the DIC group, is a leading producer of packaging and graphic solutions, color and display technologies, functional products, electronic materials, and products for the automotive and healthcare industries. Together with DIC, Sun Chemical is continuously working to promote and develop sustainable solutions to exceed customer expectations and better the world around us. With combined annual sales of more than \$8.5 billion and 22,000+ employees worldwide, the DIC Group companies support a diverse collection of global customers. As you move forward into a world of stiffer competition, faster turnarounds, more complex demands and sustainable products, count on Sun Chemical to be your partner.

Although the information presented here is believed to be reliable, Sun Chemical Corporation makes no representation or guarantee to its accuracy, completeness or reliability of the information. All recommendations and suggestions are made without guarantee, since the conditions of use are beyond our control. There is no implied warranty of merchantability or fitness for purpose of the product or products described herein. In no event shall Sun Chemical Corporation be liable for damages of any nature arising out of the use or reliance upon the information. Sun Chemical Corporation expressly disclaims that the use of any material referenced herein, either alone or in combination with other materials, shall be free of rightful claim of any third party including a claim of infringement. The observance of all legal regulations and patents is the responsibility of the user.

SUNCHEMICAL and SUNSENS is either registered trademarks or trademarks of Sun Chemical Corporation, registered in the United States of America and/or other countries. DIC is a trademark of DIC Corporation, registered in the United States of America and/or other countries and used with permission. Copyright © 2024 Sun Chemical Corporation. All rights reserved.