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# Gas Sensors and Biosensors



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# Gas Sensor

- •Solid State
- •PTFE based Gas Sensors.



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# Solid State Gas Sensors

- •Metal Electrode Pastes
- •Solid Electrolyte Pastes



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# PTFE Based Gas Sensors

- •Cottage industry techniques
- •Operator dependent
- •Highly skilled



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# Application Methods

- •Puddling
- •Stamping
- •Screen Printing
- •Stencil Printing



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# Pudding Manufacturing Method

- •Blend powder with PTFE stabilised solution.
- •Dispense into shallow containers made from aluminium foil.
- •Dry.
- •Cure.
- •Press on to PTFE substrate.



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# Pudding Formulations Disadvantages

- •Made as they are used by the operator.
- •Liquid, syringe dispensed.
- •Shelf life of a few minutes.
- •Settle readily.



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# Pudding Formulation Advantages

- •Low waste
- •Easy processing





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# Disadvantages of Puddled Electrodes

- •Operator dependent.
- •Highly skilled
- •Variable Quality of Electrodes
- •Short Shelf



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# Stamping formulations

- •Highly viscous
- •Two roll milled
- •Electrodes stamped out
- •Pressed on to PTFE



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# Stamping Formulations

- **Advantages**

- Low waste
- Small batches

- **Disadvantages**

- Inconsistent mixing
- Variability in electrodes
- Operator dependent
- High level of training



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# New Paste Design

- •Use of PTFE powders .
- •Use of binder resin.
- •Good Dispersion



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# Other Paste Properties

- •Good shelf life.
- •Good screen printing properties.
- •Good screen life
- •Good drying properties
- •Good curing properties.



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# Gas Sensor Electrodes

- •Platinum Black.
- •Iridium Black.
- •Gold.
- •Other Metals combinations.



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# Carbon Electrode Sensors.

- Blood Glucose
- Agri/Food Sensors
- Environmental



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# Blood Glucose Electrodes

- •Carbon Working Electrode Paste
- •Reference Silver/Silver Chloride Paste
- •Insulation Paste





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# Carbon Paste

- •Carbon
- •Graphite
- •Resins
- •Solvents
- •Surfactants



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# Functional Carbon Pastes

- •Mediated
- •Platinised



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# Mediated Carbons

- •Meldola'sBlue
- •Cobalt  
Phthalocyanine



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# Platinised Carbon

- •Carbon with platinum deposited on the surface
- •High surface area carbon



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# Low Temperature Working Electrodes

- •Polymeric Gold
- •Polymeric Platinum



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# High Temperature Working Electrode Paste

- •Gold Metallo-organic
- •Platinum



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# Further Functionality

- •Future GEM developments
- •Combined work with AET



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# Reference Pastes

- •Silver/Silver Chloride
- •Varying Ratios
- •90:10 to 40:60, Silver: Silver Chloride





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# Conductor Pastes

- •Carbon Conductor pastes
- •Silver Conductor pastes



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# Insulation Pastes

- •Different resin types
- •Different functionality
- •Different Colours



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# Mediator Pastes

- •Custom made mediator pastes.



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# Capillary Layers

- •Used to help draw solutions to the electrode surface



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# Spraying Formulations

- •Wetting agents



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# Selective Membranes

- •PES
- •PVC
- •Cellulose Acetate



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# Future Developments

- •Bio Dot formulations
- Bio Robot Formulations
- •Added functionality to carbon pastes



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