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Design, Construction, and Utilization of Physical Vapor Deposition Systems for Medical Sensor Fabrication

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Constructing a Triple Head Sputtering Deposition System for Novel Blood Glucose Sensor Fabrication

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Gas Manifold

The gas manifold on this system is unique because it allows closely controlled mass flow (0-200 sccm) of two different gas species. Both Oxygen and Argon gases may be applied in user controlled quantities to each head on an individual basis. This allows optimization of sputtering parameters by adjusting gas flow and type based on sputter head target material. The manifold is connected to the vacuum system to allow evacuation of residual gas to reduce contamination.

Sensor Fabrication

A novel blood glucose sensor is realized by using semiconductor manufacturing processes in the PNNA cleanroom on Portland State University campus. The substrate consists of a titanium foil laminated onto a flexible polyimide film which is then adhered to a glass slide to aid in processing. A photolithographic process is used to define regions on the substrate surface so that structures may be formed through successive coating and etching processes. Photolithography begins with covering the substrate surface in a light sensitive material called photoresist.

Vacuum System

The diagram above shows the basic outline of the vacuum subsystem. Vacuum chambers are necessary for the sputtering process for multiple reasons. The sputtering process requires subatmospheric pressure (1-100 mTorr) in order to initiate a plasma, and to reduce molecular collisions to the point that coating material can travel from the sputtering head to the substrate. Furthermore, yet lower pressure values into the high vacuum regime give the benefit of eliminating adsorbed water and residual atmospheric gases, which help provide good adhesion and consistent, quality coatings.

Control System

The control system for this system is based on a simple switch activated control panel interface. Connectors have been built into the back of the control panel so that the whole panel may be easily removed in order to perform system maintenance. LEDs show switch status on a front panel which displays the vacuum system and gas manifold diagrams. Switch position translates to valve actuation via two sets of solenoid banks wired into the control panel. Emergency off protection and vacuum safety interlocks have been included in the control system to prevent equipment damage and ensure safety.

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References: (List all, if necessary)