Donald M. Mattox
Technical Director
Society of Vacuum Coaters
440 Live Oak Loop
Albuquerque, NM 87122
505/856-7188 • FAX: 505/856-6716 • Internet: http://www.svc.org

PVD Processes: Process Flow Chart

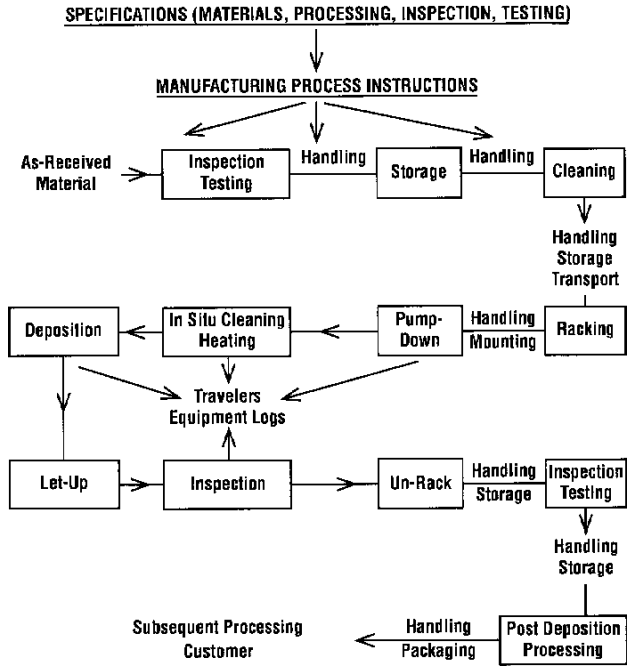
Every PVD process should have a process flow chart that depicts each stage of the processing, from the specification and testing of the as-received substrate and source material to the packaging and handling of the final thin film product. The accompanying figure shows an example of a process flow chart. All stages of the processing and product evaluation should be covered by written manufacturing process instructions (MPIs), and critical aspects of the processing and product evaluation should be covered by written specifications.

Process Specifications

Specifications (or specs) are essentially the "recipe" for the process. Specifications define what is done, the critical process parameters and the process parameter limits that will produce the desired product. Specs can also define the substrate material; materials to be used in the processing, handling and storage condition; packaging; process monitoring and control techniques; safety considerations, and any other important aspect of processing. Specs should be dated, with a procedure available that allows changes to the specifications. Reference should be made to the particular "issue" (date) of specifications. Specs should be based on accurate measurements, so it is important that calibrated instrumentation is used to establish parameter windows for the process. Equipment and non-critical process parameters usually are not specified. Specs can also be used to define the functional properties and stability characteristics of the product, as well as associated test methods.

MPIs

Manufacturing processing instructions (MPIs) are derived from the specifications as they are applied to manufacturing and evaluation procedures using specific equipment. The MPIs often contain information that is not found in the specs, but that is important to the manufacturing flow. This may be instructions concerning the type of gloves to be used with specific chemicals (*e.g.*, no vinyl gloves around alcohol; rubber gloves for acids), or may cover portions of the processing, such as handling and storage, that are not covered in the specs. The MPIs should be dated and updated in a controlled manner, and should include the appropriate manufacturing safety data sheets (MSDSs) for the materials being used.



PVD process flow chart.

Process Flow Chart

A detailed process flow chart aids in ensuring that all aspects of the processing are covered by an appropriate MPI. Without the flow chart, it is easy for some steps in the processing—such as handling or storage—to be overlooked, which can lead to process variability because that portion of the processing may not be performed in a reproducible manner.

The traveler is a document that accompanies each group of substrates processed. It documents the specifications and MPIs used, the equipment used, the processing parameters and any observations made by the operators or inspectors. The traveler is an archival document that can be used to determine how the product was processed, if questions arise concerning the performance of the product.

In manufacturing, it is important to keep equipment logs for the equipment and instrumentation being used. These logs contain information concerning when and how long the equipment was used, its performance, any modifications that were made, and any maintenance and service that was performed. The logs can be used to establish routine maintenance schedules and to determine the cost of ownership (COO) of that particular equipment.

When the equipment is being repaired or serviced, it is important to log the date, action and person performing the work. The equipment log should also contain the calibration log(s) for associated instrumentation, where applicable. **P&SF**