DDC NEWSLETTER

Volume 2, Number 2. February 15 , 2001

Comments:

The article on Mercury Lamps from the last few issues is continued below. (article by Bob Donofrio and Bob Eckel

LAMP LIFE FACTORS

Cathode Sputtering
Anode Evaporation
Envelope Darkening
Quartz Cracking
Devitrification
Solarization
Processing

The list seen above shows some factors that effect Lamp life. The first factor that affects lamp life is the "Sputtering" of the Cathode material due to ion bombardment during the start-up of the lamp when the internal pressure is low. (At full operating power sputtering is low). The second cause of lamp envelope darkening occurs during the operation of the lamp. In this mode of lamp darkening is due to the evaporation of the anode and the transport of the anode material to the envelope due to impurities within the bulb. As the lamp envelop darkens the radiation from the arc is filtered by the tungsten deposit causing a drop or decrease in lamp output. The absorption of the radiation increases the operating temperature of the lamp envelope thus leading to lower pressure vessel integrity. Since the lamps are operating at a positive pressure it is necessary that proper maintenance be used and the lamp removed prior to the time that it may constitute an explosion hazard. The rule of thumb in the lamp industry is the "70% maintenance factor". This simply says that when the output from the lamp decreases to 70% of what it was when new, it is time to change the lamp. For this reason, UV radiation output measurements are periodically taken and recorded. There are other aspects of the lamp life such as quartz cracking. This can occur if there is a sharp thermal gradient on the quartz housing this gives rise to devitrification on cooling and local stress in the quartz housing. Although the geometry changes via larger quartz surface area can reduce this lamp aging, it has been found that good lamp fabrication methods can give improved life without the increased surface area.

Lamp Stability

Lamp arc stability is extremely important when exposing the micro-pattern geometry associated with the high component density of the IC's being manufactured today. The slightest shift in the location of the arc in reference to the optical collection will re-position the IC pattern and produce a reject die in the case of step and repeat projection or even a complete wafer. The processing of the cathode before assembly of the lamp must be carefully controlled (Lamp manufacturers have "trade secret" processes to control the cathode performance).

Power Output in Actinic Wavelengths

Manufacturing cost reduction is the name of the game in IC production. This translates to reducing the time for manufacture. For most Photo-resists the reciprocity relationship holds, ie: for a given feature size, time x Intensity is a constant. Additionally, where there is a breakdown in the reciprocity law the longer time allows other competing chemical polymerization processes to take place and thus better feature control occurs with the shorter time. Therefore, the higher intensity of the actinic radiation, the faster the wafers can be produced. To achieve the maximum exposure intensities the output of the lamp in the absorption band of the PR must be maximized.

EVENTS IN DETROIT AREA

March 22nd Detroit Color Council Meeting on Automotive Design given by Bill Porter at the Troy Marriott. Contact the DDC for info.