EMULSITONE COMPANY
19 Leslie Court
Whippany, New Jersey 07981
TEL. (973)386-0053
FAX (973)503-0256

PHOSPHOROSILICAFILM 5 x 10^{20}

Phosphorosilicafilm is a dopant formulation designed to produce phosphorous diffused layers in semiconductor wafers. Phosphorous diffused layers may be produced routinely with sheet resistance profiles over the wafer surface flatter than 1-2%. Similar reproducibility from wafer to wafer and from run to run is easily achieved. When applied by spinning or spraying, a film forms which consists of silica with phosphorous dissolved in it. This phosphorous doped silica layer provides an erfc source, and the sheet resistance decreases linearly with the square root of the diffusion time.

Phosphorous concentrations required for emitters with high emitter efficiency in high frequency transistors and integrated circuits are obtained with films about 2000 angstroms thick. For high voltage devices requiring deep penetration and low sheet resistances less than 1 ohm/square, sprayed-on films are used.

Phosphorosilicafilm contains ethyl alcohol as solvent. In addition to ethyl alcohol, methanol or isopropyl alcohol may be used as diluents if it is desired to dilute the "as-received" formulation.

Phosphorosilicafilm is hygroscopic and for extended storage, the container should be securely fastened to prevent access of water vapor. The bottle may be left open for reasonable periods of time with no deleterious effects. After films have been applied by spinning or spraying, the wafers may be processed directly. However, if it is desired to store the wafers for extended periods of time after film application and prior to diffusion, the films should be hardened so that the layer is insoluble in water, and the wafers may be stored with no loss in doping characteristics. If it is desired to photo-etch Phosphorosilicafilm, higher temperature or longer heat soak is necessary for good adhesion of the photo-resist and to prevent leaching of phosphorous from the glass film.

Application

The viscosity of Phosphorosilicafilm is quite low, and the material wets readily to silicon surface. Approximately 1-1.5 ml will cover a four-inch wafer. For shallow penetrations where the source is not depleted, the sheet resistance obtained is independent of spin speed. A spin speed should be selected which minimizes the lip which builds up at the edge of the wafer. In 10 to 15 seconds of spinning, the film will be formed. For spraying, the material should be diluted to yield a film less than 10,000 angstroms thick. A thicker film will develop cracks on drying.

Diffusion

Phosphorosilicafilm is useful for a wide variety of diffusion recipes. If you have special requirements, Emulsitone can also adjust the glass/phosphorous concentration, generating C_0s from 1 x 10^{19} to 1 x 10^{21}. Typical diffusion results with the standard material are obtained as shown in the table following.

Spin Speed (rpm)	Diffusion Temperature (ºC)	Time (min.)	Ambient	R_s (ohms/square)	C_o (Atoms/cm.)
3000	1050	20	N_2:O_2 4:1	5	10^{21}
3000	1200	60	N_2:O_2 4:1	2	10^{21}
Sprayed-on 6000 angs.	1200	480	N_2:O_2 1:1	0.5	10^{20}

Surface Condition

Phosphorosilicafilm will yield no surface damage or deposits. The phosphorous doped silica film is easily removed in dilute HF solution.

Alphabetic Product Listing	Home	E-mail	Material Safety Data Sheet