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PHOSPHOROSILICAFILM 3 x 10^{20}

Phosphorosilicafilm 3 x 10^{20} is a dopant formulation designed to produce phosphorous diffused layers in Silicon for Solar Cells. These 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 is generated that 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.

Phosphorosilicafilm 3 x 10^{20} 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 3 x 10^{20} 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.

Application

The viscosity of Phosphorosilicafilm 3 x 10^{20} 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.

Diffusion

Diffusion is carried out in nitrogen atmosphere with 1-2% oxygen. Typical diffusion results are obtained as shown in the table following. Refer to a standard textbook for your desired profile.

Diffusion Temperature (ºC)	Time (min.)	X_j (junction depth)	V/I (ohms/square)	Q (Atoms/cm.)
925	15	0.13	18	1.0E15
925	30	0.18	12	1.4E15
950	15	0.18	12	1.5E15
950	30	0.26	9	2.1E15
975	15	0.26	8	2.1E15
975	30	0.37	6	2.9E15

Surface Condition

Phosphorosilicafilm 3 x 10^{20} will yield no surface damage or deposits. The phosphorous doped silica film is easily removed in dilute HF solution.

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