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NASA TECH BRIEF

Process Facilitates Photoresist Mask Alignment on SiC Crystals

The problem:

Ensuring proper orientation of photoresist masks on silicon carbide crystals used in the fabrication of semiconductor devices, such as field effect transistors. In order to apply the photoresist masks it is necessary to delineate the p and n junctions which intersect the surface of the crystal. At both low and high impurity concentrations in a silicon carbide crystal of less than 1 mil in thickness, the p and n regions on a planar surface cannot be distinguished from one another by the human eye.

The solution:

The growth of silicon dioxide on a silicon carbide crystal by heating in a water vapor-saturated gas (e.g., oxygen or argon) at 1170° to 1175°C will sharply delineate p,n junctions which intersect the surface of the crystal. The delineation is manifested by the appearance of a different color over the p region from that over the n region, the colors being dependent on the duration of the oxidation process. The color difference is caused by the well-known optical interference phenomenon associated with thin films. The oxide apparently grows at different rates on p-type and n-type materials, respectively.

How it's done:

After the normal diffusion procedure is completed, the crystal is lapped to planarity and steam-oxidized for 45 minutes at 1170° to 1175°C. This process yields an oxide layer, approximately 3000 angstroms thick, which exhibits a sharply delineated blue-gold color contrast between the n-type and p-type regions. The contrast is most pronounced in yellow light, and subsequent alignment of photoresist masks is best performed under this illumination.

Note:

Inquiries concerning this innovation may be directed to:

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Patent status:

No patent action is contemplated by NASA.

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