

**ARGON/AMMONIA RAPID THERMAL ANNEALING FOR SILICON
WAFERS, SILICON WAFERS FABRICATED THEREBY AND
CZOCHELSKI PULLERS FOR MANUFACTURING
MONOCRYSTALLINE SILICON INGOTS**

Abstract of the Disclosure

A silicon wafer is provided having controlled distribution of defects, in which denuded zones having a sufficient depth inward from the surface of the wafer are combined with a high gettering effect in a bulk region of the wafer. In the silicon
5 wafer, oxygen precipitates, which act as intrinsic gettering sites, show vertical distribution. The oxygen precipitate concentration profile from the top to the bottom surfaces of the wafer includes first and second peaks at first and second predetermined depths from the top and bottom surfaces of the wafer, denuded zones
10 between the top and bottom surfaces of the wafer and each of the first and second peaks, and a concave region between the first and second peaks, which corresponds to a bulk region of the wafer. For such an oxygen precipitate concentration profile, the wafer is exposed to a rapid thermal annealing process in a gas mixture atmosphere comprising ammonia (NH₃) and argon (Ar) at temperatures below about 1200°C. Using such a rapid thermal annealing process, slip dislocation can be reduced in the
15 device regions of the wafer, and silicon dioxide sublimation on the rapid thermal annealing chamber also can be reduced.

Fig. 10