apparatus. To determine the threshold M/T, a threshold defect count (e.g., a maximum defect count desired by the manufacturer and/or customer such as less than 30 defects, less than 20 defect or less than 10 defects of a size of 0.2 μm or more) is established. A plurality of single crystal silicon ingots are grown in which at least two of the ingots (e.g., 2, 3, 5, 10, 25, 100 ingots) are grown with different ratios of M/T. The defect count in one or more wafers sliced from the plurality of single crystal silicon ingots is measured (e.g., with an SP1 inspection tool). The ratio of M/T for single crystal silicon ingots from which wafers were sliced that have a defect count below the threshold defect count is determined based on the measured defect counts (i.e., a threshold M/T is determined based on M/T values in which the defect count was at or below the defect threshold count).

[0039] In some embodiments, the threshold M/T at which M/T is controlled to be greater than is 40 grams per hour. In other embodiments, the threshold M/T is 50 grams per hour or even 55 grams per hour. In some embodiments, the threshold M/T at which M/T is controlled to be greater than is 60 grams per hour. In yet other embodiments, the threshold M/T at which M/T is controlled to be greater than is 70 grams per hour. The threshold M/T (and actual M/T used in the ingot puller apparatus to grow an ingot) may be bound by the practical limits of the ingot growth process (e.g., without inhibiting flow of solid polysilicon into the melt such as when solid polysilicon begins to mound on top of the buffer members). For example, M/T can be controlled to be above a threshold

carried by the melt through the openings within each weir which allows bubbles to reach the solid-melt interface. The buffer members may act to prevent entrapment of the inert gas into the melt by preventing polycrystalline feedstock from dumping directly into the melt. The buffer members may also provide surface area and nucleation points for inert gas bubbles to aggregate, thereby increasing the size of the bubbles to allow them to become buoyant. By increasing the ratio of the mass M of the batch of buffer members added to the melt to the time T between adding the batch of buffer members to the melt and the start of the ingot main body growth to be at least 60 grams/hour, the efficiency of the buffer members in reducing inert gas impingement and/or dissipation of inert gas bubbles is increases.

EXAMPLES

[0048] The processes of the present disclosure are further illustrated by the following Examples. These Examples should not be viewed in a limiting sense.

Example 1: Number of Voids in Wafers Grown from Ingots in which M/T was less than a Threshold Value of M/T

[0049] Single crystal silicon ingots were grown in a continuous Czochralski method in an ingot puller apparatus similar to the apparatus shown in Figure 3. The silicon ingots were grown with a 300 mm main body portion and were doped with red phosphorous. An initial charge of polycrystalline silicon was added to the outer melt zone, middle melt zone and inner melt zone. Quartz cullets (4 kg) were added to the top of the polycrystalline feedstock in the outer melt zone. After the charge was melted, additional polycrystalline silicon was added through the