

ABSTRACT OF THE INVENTION

TITLE OF THE INVENTION: Method and apparatus for deposition removal and precision cleaning of high purity ceramic process kits used in nanoscale semiconductor manufacturing.

As semiconductor device geometry continues to shrink from currently at about 0.18 μ m to nanoscale of 70nm, and the increases of wafer sizes, there is a need for more advanced material with higher density, purity as well as good particle and/or metal contamination control. The fabrication of nanoscale semiconductor devices requires the use of high purity ceramic process kits having a high level of surface purity, whether those kits are new or reconditioned. The present invention includes a Best-Known-Method (BKM) and apparatus for deposition removal and precision cleaning of high purity ceramic process kits using chemical and mechanical processing. The ceramic process kits are cleaned using the best-known-method using both mechanical cleaning such as high pressure water-jet cleaning, clean-dry-air blowing, bead blasting, CO₂ cleaning, and oven air baking, as well as chemical processing by treating it to the different mix-acids and chemical solvents in order to remove the organic/inorganic and metallic impurities by-products, stains, adhesions and contaminants by-products, without damaging or destroying the surfaces of the ceramic process kits. The ceramic kits cleaned using the inventive process have been found to have a surface contaminant particle density of no more than about 0.3 μ m per square centimeter. In addition, the ceramic kits have also been found to have a surface trace metal contaminant concentration of no more than about 300 surface concentration (x10¹⁰ atoms/cm²), as analyzed by ICPMS (inductively-coupled plasma mass spectrometry) for metal contamination such as Aluminum, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Gallium, Germanium, Iron, Lead, Lithium, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Sodium, Strontium, Tin, Titanium, Tungsten, Vanadium, Zinc and Zirconium, following application of this invention. This invention may be used to process any number of types of parts having ceramic surfaces, including, without limitation, parts having surfaces comprised of alumina, aluminum oxide (A12O3), silicon carbide (SiC), silicon nitride (Si3N4), yttria (Y2O3), zirconia (ZrO2), aluminum nitride (A1N), and quartz, Spinel, and parts having chemical vapor deposited ceramic coatings, plasma spray ceramic coatings, and anodized ceramic coatings.

FIGURE 1