

HARMONIZED TARIFF SCHEDULE of the United States (1994) -- Supplement 1  
Annotated for Statistical Reporting Purposes

XVI-3

- (iii) Etching and stripping equipment - used for etching or cleaning surfaces of the wafers.
- (A) Wet etching equipment - in which chemical etching materials are applied by spraying or immersion. Spray etchers provide more uniform results than bath etchers, since they perform the operation on one wafer at a time.
  - (B) Dry plasma etching - in which etching materials are presented as gases within a plasma energy field, providing an anisotropic etch profile.
  - (C) Ion beam milling equipment - in which ionized gas atoms are accelerated toward the wafer surface. The impact results in the top layer being physically removed from the surface.
  - (D) Strippers or ashers - using techniques similar to etching this apparatus removes the spent photoresist from the surface of the wafer after it has served its purpose as a "stencil". This equipment is also used for removal of nitrides, oxides, and polysilicon, with an isotropic etch profile.
- (iv) Lithography equipment - used to transfer the circuit designs to the photoresist coated surface of the semiconductor wafer.
- (A) Equipment for coating wafers with photoresist - these include the photoresist spinners which are used to apply liquid photoresist evenly over the surface of the wafer.
  - (B) Equipment for exposing the photoresist coated wafer with the circuit design (or a part thereof):
    - (1) Using a mask or reticle and exposing the photoresist to light (generally ultraviolet) or, in some instances, X-rays:
      - (a) Contact printers - where the mask or reticle is in contact with the wafer during exposure.
      - (b) Proximity aligners - similar to contact aligners except actual contact doesn't take place between the mask or reticle and the wafer.
      - (c) Scanning aligners - which use projection techniques to expose a continuously moving slit across the mask and wafer.
      - (d) Step and repeat aligners - which use projection techniques to expose the wafer a portion at a time. Exposure can be by reduction from the mask to the wafer or 1:1. Enhancements include the use of an excimer laser.
    - (2) Direct write on wafer equipment - these apparatus operate with no mask or reticle. They use a computer controlled "writing beam" (such as, an electron beam (E-beam), ion beam or laser) to "draw" the circuit design directly on the photoresist coated wafer.
  - (C) Equipment for developing exposed wafers - these include chemical baths similar to those used in photographic laboratory applications
- (d) Assembly equipment
- (i) Dicing equipment - these include sawing machines and scribing machines (including laser scribers) and dicing accessories such as wafer breaking equipment.
  - (ii) Die bonding equipment - which installs the die to the package by soldering or gluing
  - (iii) Wire bonding equipment - used for attaching thin wires or tapes (usually of gold, aluminum or copper) from the die bonding pads to the corresponding pads on the package.
  - (iv) Packaging equipment - which are used to encapsulate or package a semiconductor device. They include sealing furnaces, lid welders, plastic encapsulation presses, lead trim and form equipment, package deflashers, and tin dip and solder plate equipment.
- (e) Testing and inspection equipment
- (i) Optical inspection equipment - These include equipment that "examines" portions of the wafer surface and compares them either to a standard pattern or to other portions of the wafer surface.
  - (ii) Electrical testing equipment - These include computer controlled systems that test the functions and electrical specifications of semiconductor devices through the application and detection of electrical signals or patterns. Testing is performed on both unencapsulated dice and packaged integrated circuits.