ME477: Quiz #6

Fall 2003

1. (1pt) Explain the motivation for using internal diameter of the ring-shaped saw for slicing wafers from a silicon boule. Better control over flatness, thickness, parallelism, surface characteristics.

2. (1pt) Explain the reason for using more than one mask during the processing of IC chips. Producing IC chips requires a series of steps of adding and etching different materials.

3. (1pt) What is the main difference between Solid State Welding and Fusion Welding? Melting of the base materials (Fusion Welding)

4. (1pt) Explain why the high thermal conductivity of a base material typically means that weldability is not desirable. The heat energy is dissipated into the other area of the high thermal conductivity materials.

5. (1pt) Designing a product that can be disassembled easily is becoming an important issue for industries. What is the main reason for that trend? Recycling

6. (1pt) In Rapid Prototyping, between STL and SGC, which process is more efficient and why? SGC is more efficient as the process is done a layer at a time.

7. (2pts) The unit melting energy of a GTAW operation is 9.3J/mm² for stainless steel. The operating condition used was E=25volts, l=125Amps, f₁=0.65 and f₂=0.7. The filler material is available in form of wire whose diameter is 3mm which is mixed equally with the base material. Determine the cross-sectional area of weld bead and the feed rate of the filler wire for the travel velocity of 5mm/sec.

(a) \[ H_{Rw} = f_1 f_2 E I = U_m A_w v; \] \[ 0.65(0.70)(25)(125) = 9.3(A_w)(5); \] \[ A_w = 30.6 \text{ mm}^2 \]

(b) \[ A_w v = 30.6(5) = 153 \text{ mm}/\text{s}; \] Filler wire \[ A = \pi D^2/4 = \pi(3)^2/4 = 7.07 \text{ mm}^2 \]

At 50% filler metal, feed rate of filler wire = 153(0.50)/7.07 = 10.82 mm/s

8. (2pts) Two plates are welded in angle as shown below. If the strength of the welds is 90% of the yield strength (also 100MPa) of the base materials in tension and 45% of the yield strength of the base materials in shear, determine the acceptable range of the weld angle, \( \theta \), to withstand the imposed stress. Half the angle in Mohr circle, \( 18.5<\theta<32.1 \)