University of technology
Laser and optoelectronics eng. Dept.

# LASER APPLICATION COURSE
# 4TH YEAR
# LEC.10

# *Laser Scribing*

- ***1.Definition:***
- ***Scribing*** is a process for making a groove or line or line of holes either fully penetrating, or not, but sufficient to weaken the structure so that it can be mechanically broken[8].
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- ***2.The goal***
- The usual method of scribing a wafer is by the use of diamond scriber; however a diamond scriber produced residue on the wafer that may lodge between microcircuit components, for the later reason laser scribing is found.[2]
- The quality, particularly for silicon chips and alumina substrates, it is measured by the lack of debris and low heat affected zone. Thus low energy or high power density pulses are used to remove the material principally as vapor..
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- ***3.Advantages***
- 1.Clean (lack of debris )
- 2. Fast.
- 3.Accurate.
- 4. Safe (low heat affected zone).
- 5. No mechanical contact with the workpiece.

# QUESTIONS

- **Q2.1:In each case, choose the best option:**
- **1. In cutting an drilling by laser a long focal length lens is used in order to produce**
- (a) faster processes.
- (b)Narrow kerfs & reduce the tendency.
- (c) very clean kerf.
- **2. The goal for exchanging laser scriber instead of diamond scriber is**
- (a) diamond scriber requested a high capital.
- (b) diamond scriber produced residue on the wafer that may lodge between microcircuit components.
- (c) laser scriber produced residue on the wafer that may lodge between microcircuit components.
- (d) laser scriber can be easily automated.
- **3. The goal from used laser in cladding processes is**
- (a) The laser provided thin layer from cladding alloys for use.
- (b) The laser provided fat layer from cladding alloys for use.
- (c) The laser provided narrow range from cladding alloys for use.
- (d) The laser provided wide range from cladding alloys for use

- **4. In surface hardening laser is scanned across a hardenable material to raise the temperature near the surface above the**
- (a) latent heat.
- (b) vaporization temperature.
- (c) melting temperature.
- (d) freezing temperature.
- **5. For practical laser beam cladding a power density of about**
- (a) $10Wmm^{-2}$ & a beam interaction time of about 1 second
- (b) $1000Wmm^{-2}$ & a beam interaction time of about 1 second
- (c) $100Wmm^{-2}$ & a beam interaction time of about 1 second
- (d) $100Wmm^{-2}$ & a beam interaction time of about 10 second

- **Q2.2:** ***Proof*** that Penetration speed (***$V_c$***) equal to:
- $$V_C = \frac{dH}{Z\rho(CT_V + L_V)}$$
- **Q2.3:**Estimate the hole diameter in a Nickel sheet (***1mm***) thickness. Using pulse Nd:YAG with a (***5kW***) peak power output. And pulse duration (***0.11s***).
- ***C = 444***
- ***$L_V$ =6.47x$10^6$***
- ***ρ = 8900***
- ***$T_V$ = 3110***
- ***Answer: (d = 1 mm)***
- **Q2.4:** Determine the peak power required to drilling a sheet of Nickel with (***1mm***) thickness, if the pulse duration is (***0.11s***), and the diameter of hole (***1mm***)
- ***C = 444***
- ***$L_V$ =6.47x$10^6$***
- ***ρ = 8900***
- ***$T_V$ = 3110***
- ***Answer: (P = 5 kW)***

- **Q2.5:** Estimate the ***cutting speed for Aluminum*** by used laser beam at power (***3Kw***) & focused spot (***0.57 mm***), if the aluminum has thickness (***13 mm***).
- ***C = 903***
- $L_V = 10.9 \times 10^6$
- ***ρ = 2710***
- $T_V = 2720$
- ***Answer:*** $(V_c = 14\ mm/s)$
- **Q2.6:** Estimate the *size of the focused spot diameter* required to achieve the cutting rates quoted for a metal cutting speed equal to (*32.3 mm/s*), thickness (*2.5 mm*) & power output (*1kW*) with thermal constant:
- ***C = 435***
- $L_V = 6.8 \times 10^6$
- ***ρ = 7870***
- $T_V = 316$
- ***Answer: (d = 0.25 mm)***