

Gaser och gasteknik vid laserbearbetning

Borlänge 2004-04-20



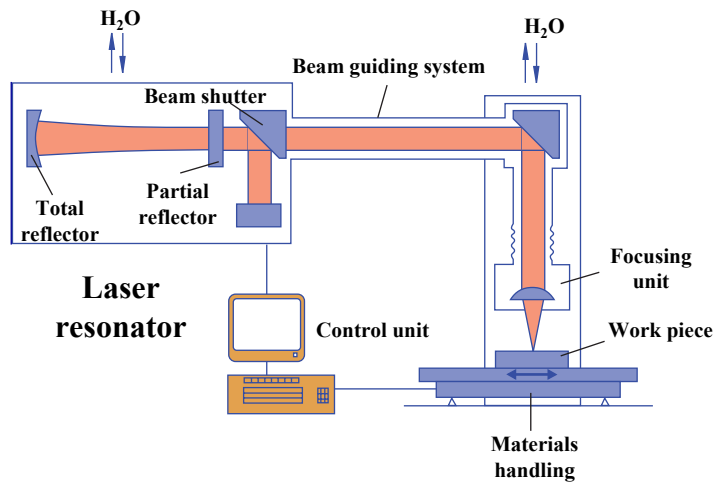
Bo Williamsson, AGA Gas AB

Gaser och gasteknik vid laserbearbetning

- ✓ Gas vid laserbearbetning, varför det ?
- ✓ Lasergaser
- ✓ Gaser för skärning av olika material
- ✓ Utveckling och trender
- ✓ Exempel på applikationer
- ✓ Nya laserapplikationer



Gas vid laserbearbetning, varför det ?

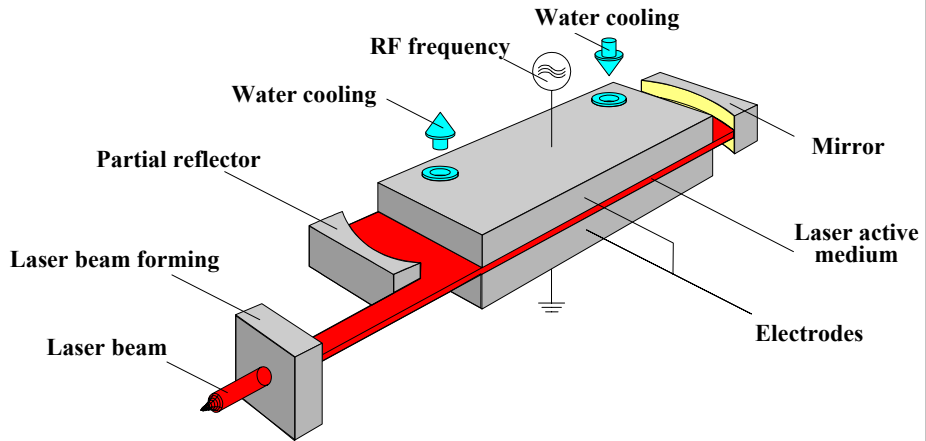


Lasergaser

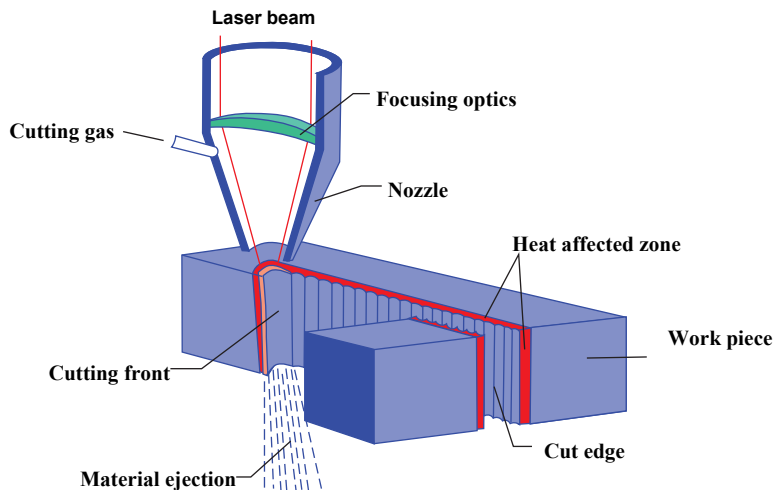
- ✓ Grundkomponenter: Helium, Nitrogen, Koldioxid
- ✓ Höga kvalitetskrav, framför allt vad gäller fukt och kolväten.
- ✓ Speciellt anpassad utrustning (regulatorer etc)
- ✓ Ny teknik ger lägre förbrukning, t.ex SLAB-lasern.



High power CO₂ laser - no-flow SLAB laser



Skärgasens funktion....



Gaser för skärning av olika material....

Konstruktionsstål, Rostfria material

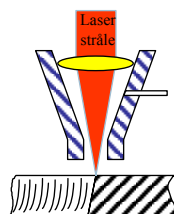
Oxygen

Nitrogen

Gasblandningar

Krav på skärhastighet, materialtjocklek

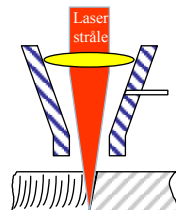
Snittkvalitet mm avgör valet av skärgas.



**Skärgas:
oxygen**

Laserskärning med oxygen (oxiderande gas)

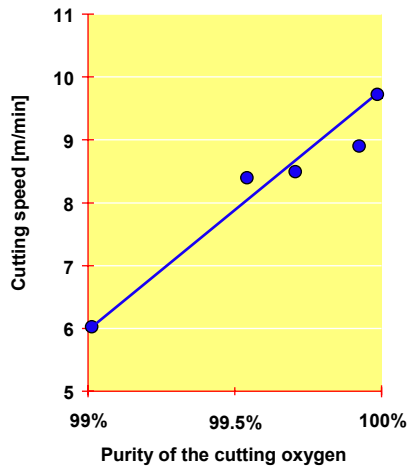
Materialet värms upp till antändningstemperatur och förbränns i oxygenstrålen.



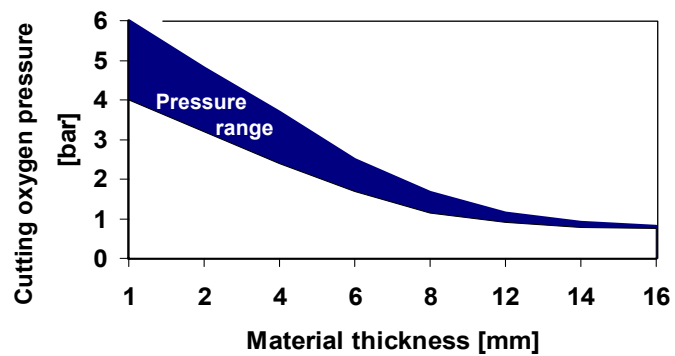
**Skärgasgas:
nitrogen**

Laserskärning med nitrogen (inert gas)

Materialet smälts av laserstrålen och spolas ut ur snittet med hjälp av nitrogengasstrålen.



Material:	1 mm mild steel
Cutting gas:	oxygen
Laser power:	800 W
Oxygen pressure:	3 bar
Nozzle orifice:	1 mm
Nozzle stand-off distance:	0.3 mm
Focal length of the lens:	64 mm



Thicker material requires precise pressure regulation!

Material thickness: 2 mm stainless steel

Laser cutting gas: Oxygen

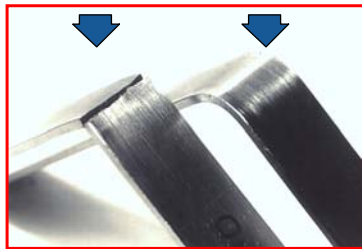


Weld defects caused by oxide inclusions!

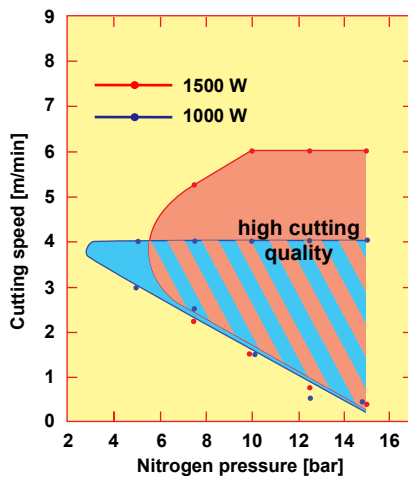
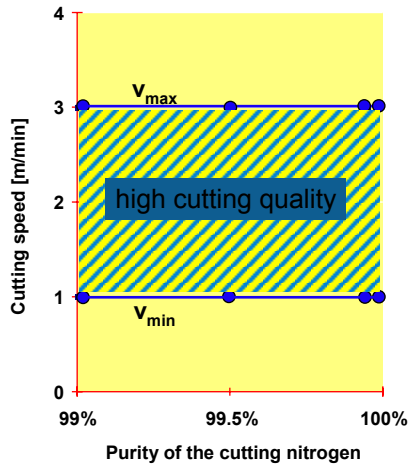
Laser cutting of 2 mm stainless steel and subsequent TIG welding.

Cutting gas
Oxygen

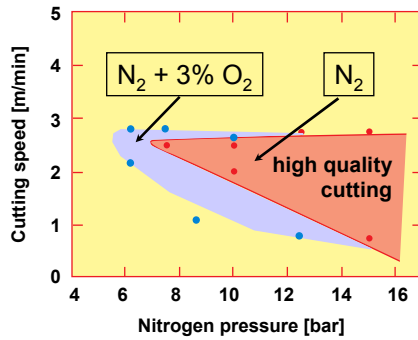
Cutting gas
Nitrogen



Insufficient formability due to oxide inclusions!



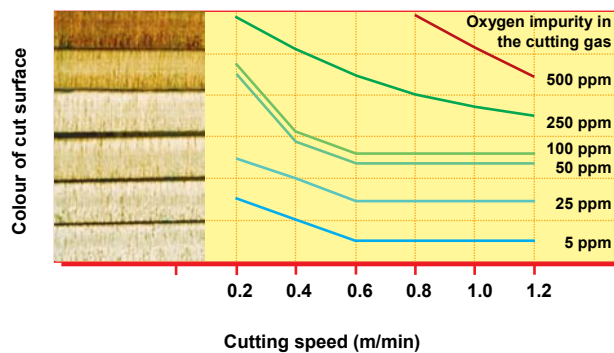
Higher cutting speed requires
 higher laser power!



Oxygen admixtures enlarge the cutting area towards lower pressures

Effect of oxygen impurities in the cutting nitrogen

Material: 3 mm AISI 304, laser power: 1.5 kW, gas pressure: 15 bar



Corrosion resistance

Machining procedure

Turned, reference

Laser cutting with nitrogen:

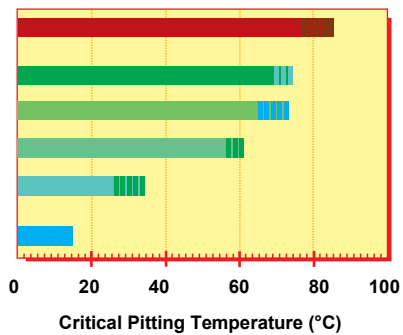
5 ppm oxygen

25 ppm oxygen

100 ppm oxygen

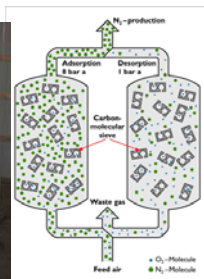
500 ppm oxygen

Laser cutting with oxygen



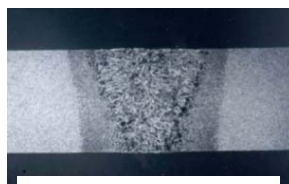
Leveransformer, skärgaser

- ✓Flaskor/paket
- ✓Flytande gas
- ✓On site Supply



**Ar (100%)**Source: Linde, *iwb*

Material: St 37
Laser power: 3000 W

**Ar (80%) CO₂ (20%)**Source: Linde, *iwb*

Thickness: 3 mm
Speed: 0,5 m/min

Lasemarknaden i Sverige

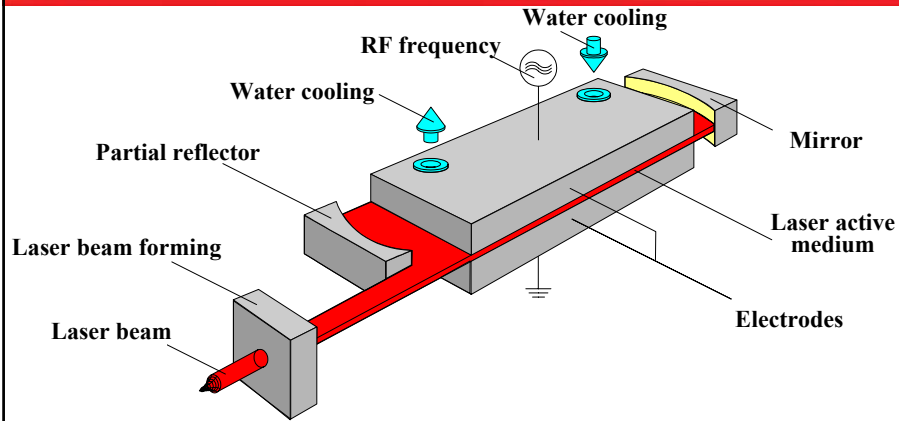
- ✓ Tillväxt ca 10 % / år
- ✓ Snart 500 CO₂-lasrar
- ✓ Övervägande andel 2D-skärning
- ✓ 3D-skärning
- ✓ Svetsning
- ✓ Trumpf, Bystronic, Amada, Mazak, Messer Griesheim, Prima, Finnpower, LVD.....
- ✓ Väckande skärvolym p.g.a konstruktionsutveckling och övergång till höghållfasta material.
- ✓ Nd:YAG ?
- ✓ Ökad internationalisering

Utveckling inom laserområdet

- ✓ Co₂-laser
- ✓ Nd:YAG-laser
- ✓ Diodlaser

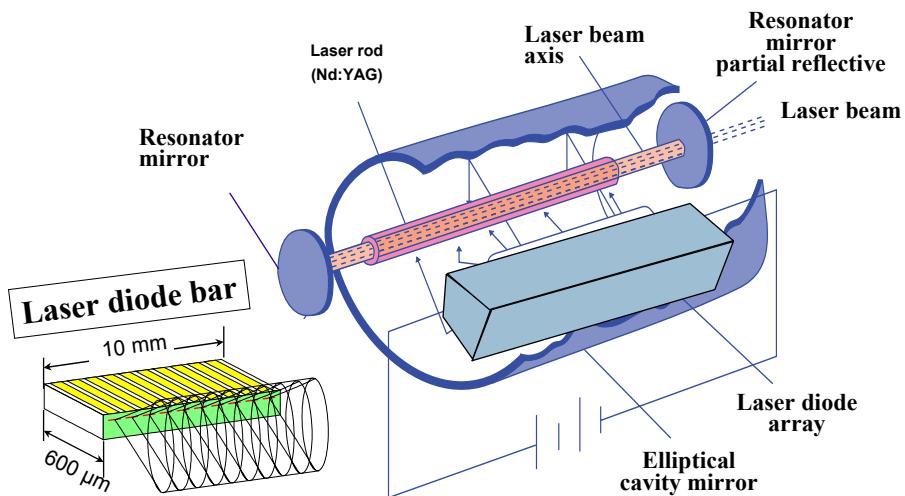
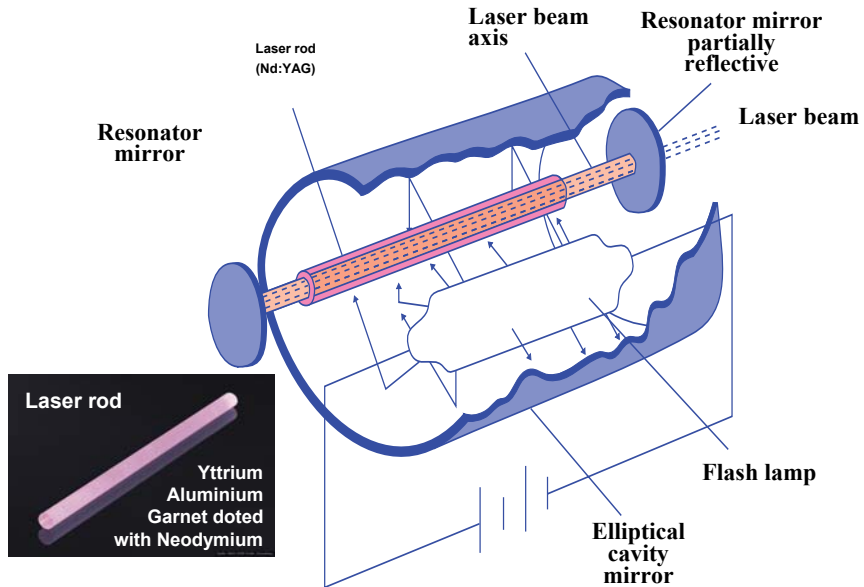
Koldioxidlaser

- ✓ Högre lasereffekter
- ✓ Tjockare material
- ✓ Plåthanteringssystem
- ✓ Linjärmotorer
- ✓ Slablaser



Fasta tillståndets lasrar

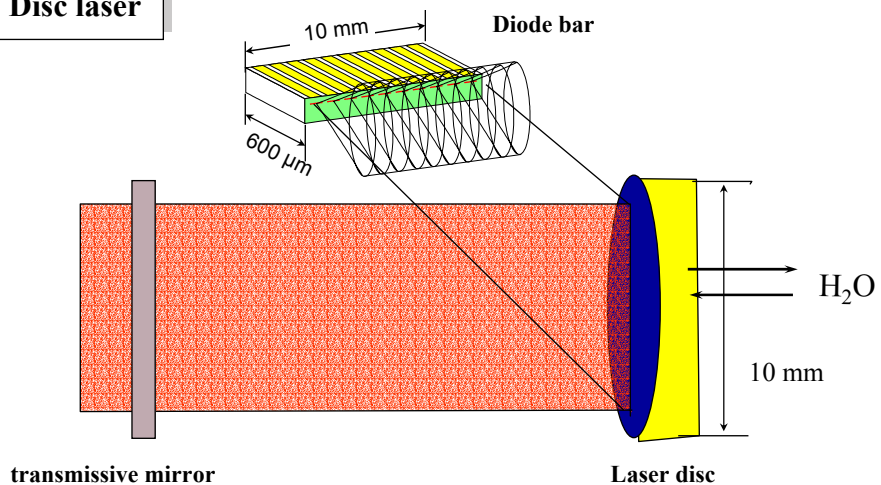
- ✓Nd:YAG
- ✓Lamp-, diodpumpade
- ✓Högre effekter
- ✓Disklasrar
- ✓Diodlasrar



Nd:YAG laser, fibre optics

- ✓ Simple beam splitting
- ✓ Safe beam delivery over long distances
- ✓ Easy 3D processing (e. g. with a robot)

Disc laser

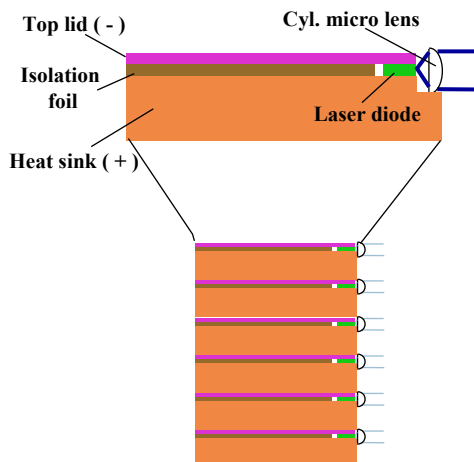


High-Power Diode Laser (HPDL)



ROFIN DL x50	500 W
ROFIN DL x75	750 W
ROFIN DL 010	1000 W
ROFIN DL 015	1500 W
ROFIN DL 020	2000 W

Diode laser, diodes and diode stacks



Diode stack 250 W

