Theme : Performance & Process Improvement

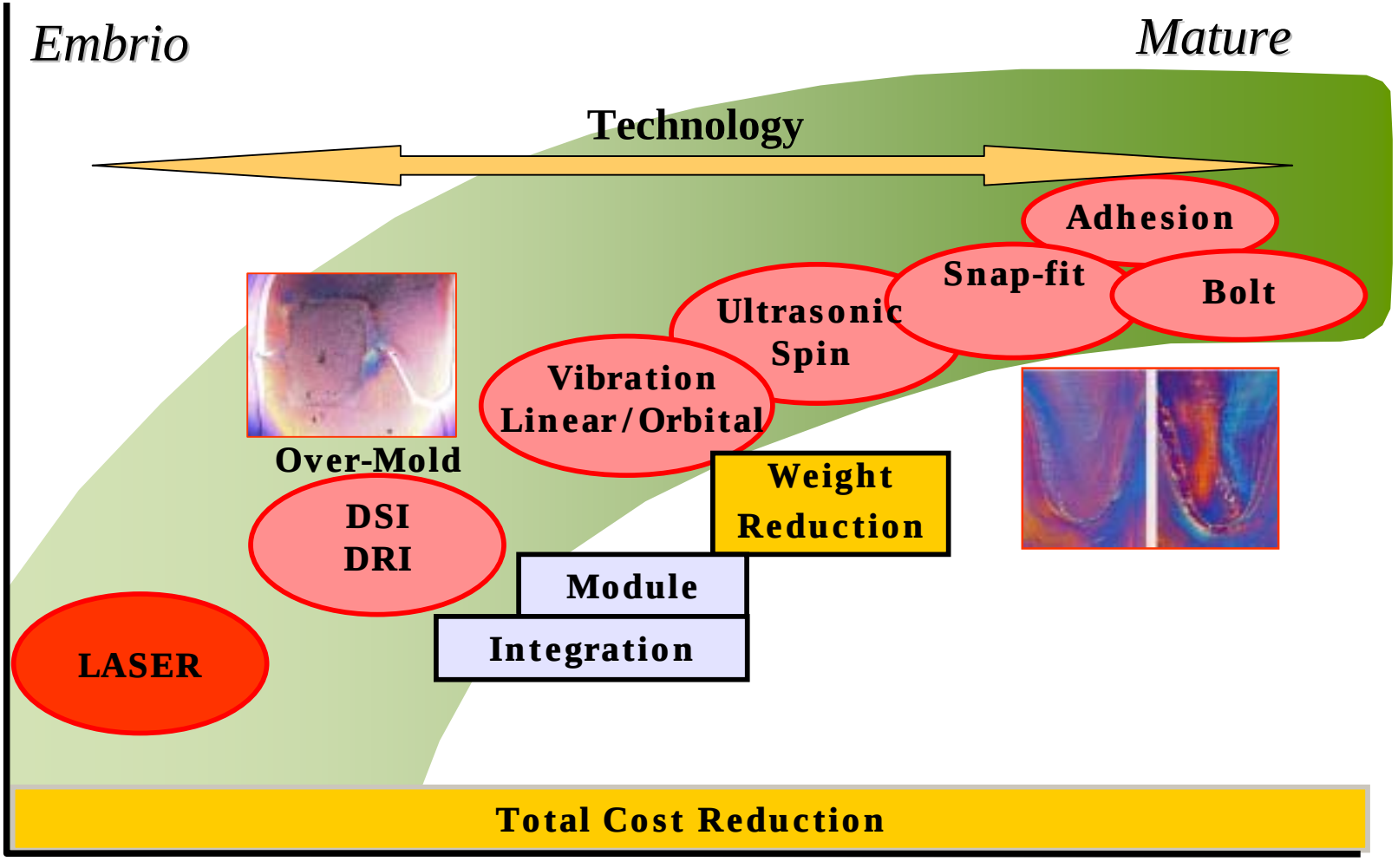
LASER WELDING :

A New Assembling Method for a Production Benefit

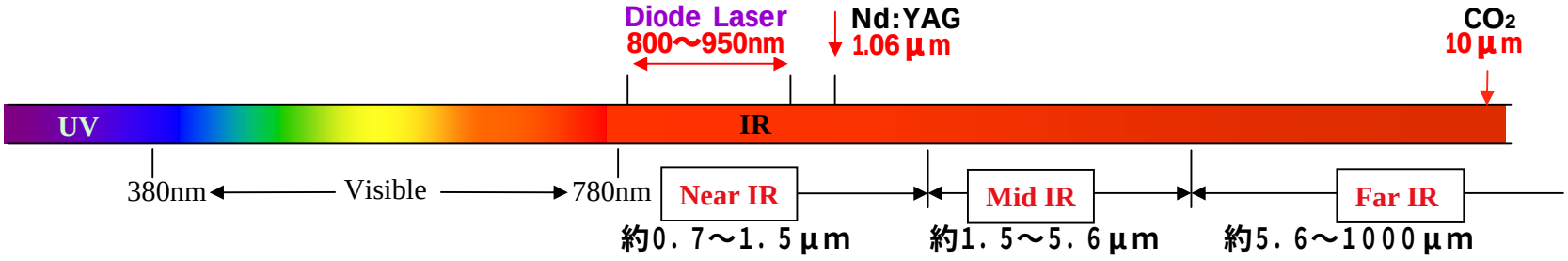
DUPONT

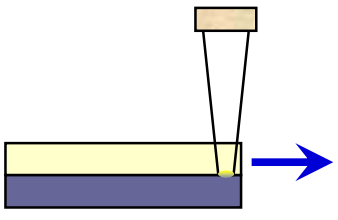
The miracles of science™

Positions of the LASER Welding Assembly

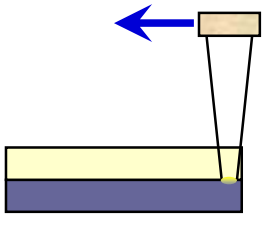


LASER Welding Summary

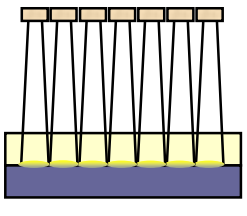




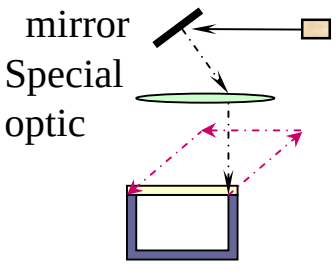
Part's move



Scanning

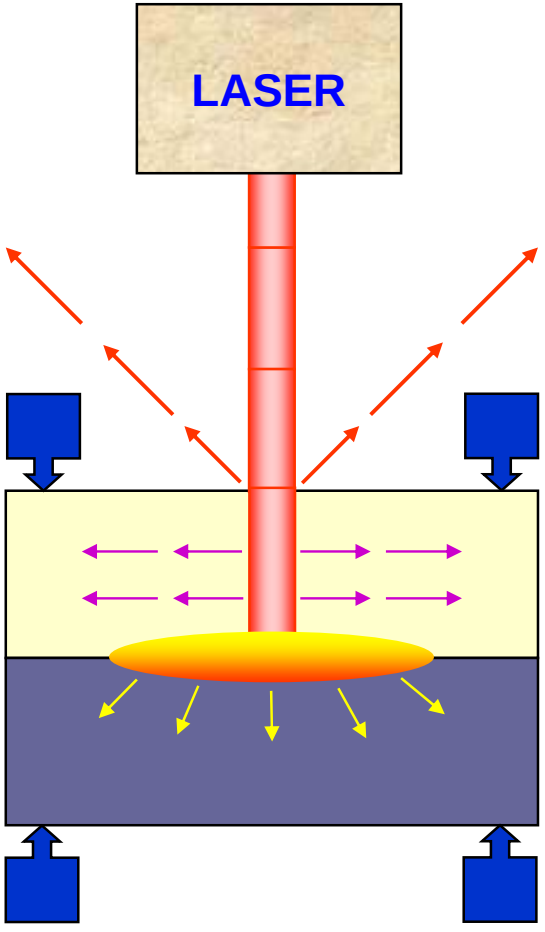


Simultaneous multi-head



Rapid multi-scanning

LASER Welding Principle



Surface Reflection
Reflecting Energy

Clamping Pressure

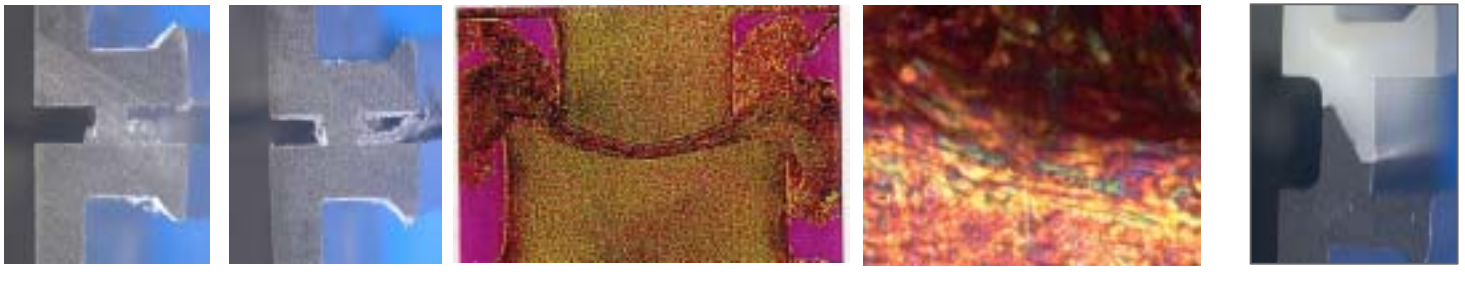
Transmissive
Scattering Energy

Absorb
Absorbed Energy

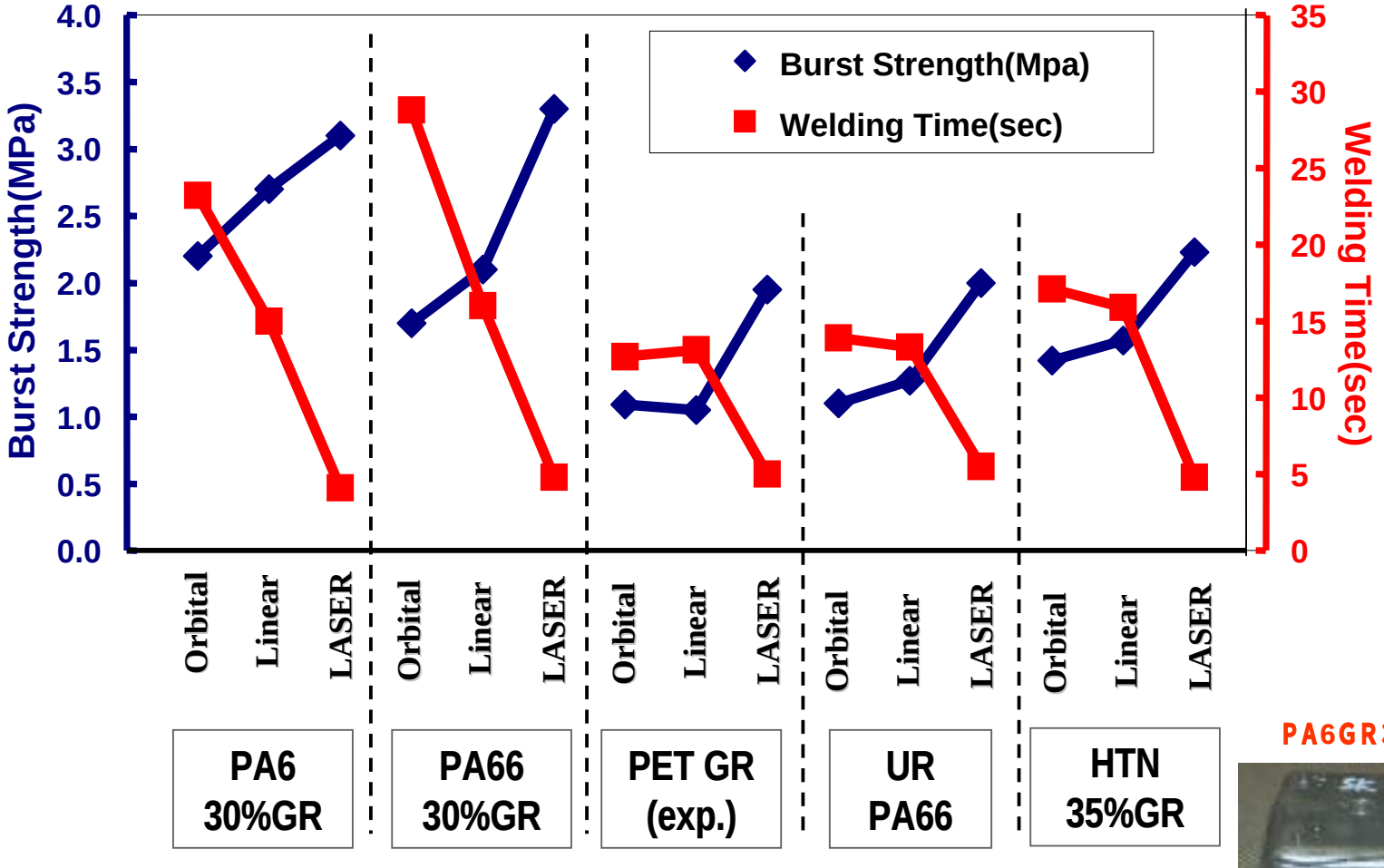
Power / Speed
Focus Diameter
Material
Part Design

Benefits of LASER Welding Assembly

- **Clean : no flash/no barrs**
- **Fast : no holding cycle time**
- **Strong : cross link of GF at joint surface**
- **Inexpensive : Facility/total cycle**



Comparison 3 methods ; Welding Time , Burst Strength



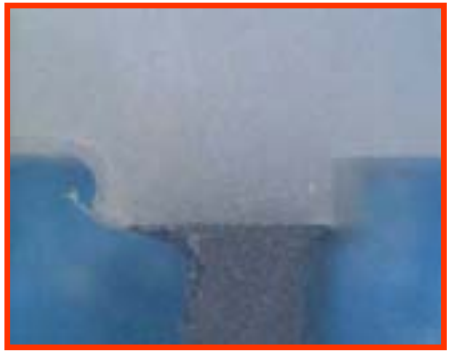
PA6GR30

, no flash , less facility cost

Break at typical area Not a joint

Comparative Look ; cross sectional observation

Linear Vibration Welding



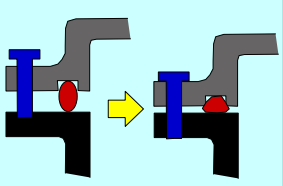
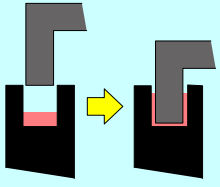
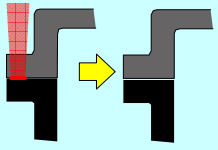
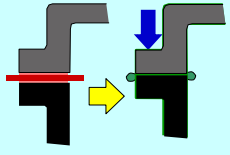
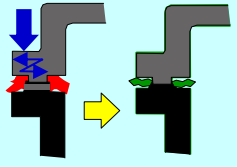
Laser Welding

Orbital vib. welding

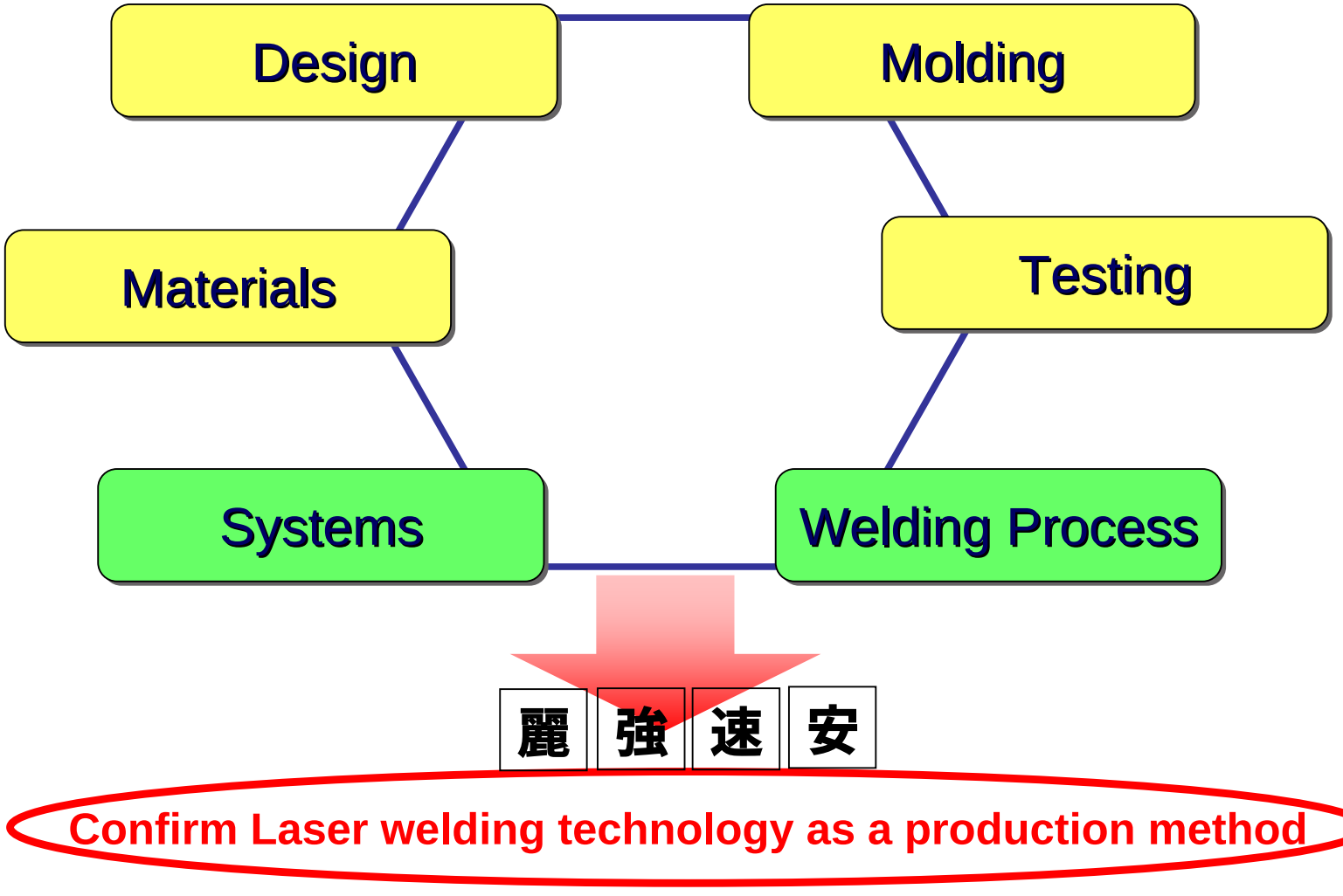
Ultrasonic welding

Adhesion Seal joint

Comparison with the other assy. mehods

	Bolting	Adhesion	LASER	Hot Plate	Linear welding
					
Reliability	◎	△ - ○	◎	◎	◎
Effect to inner	○	○	◎	△ (Thermal)	× (Vibration)
Aesthetic	△	△ - ○ (color change)	◎	△ (Flsdh)	△ (Flash)
Design freedom	△	○ (Warpage)	○ (Warpage)	△ (separation)	△ (Separation)
Productivity	△	△ (Curing)	◎	△ (weld time)	◎

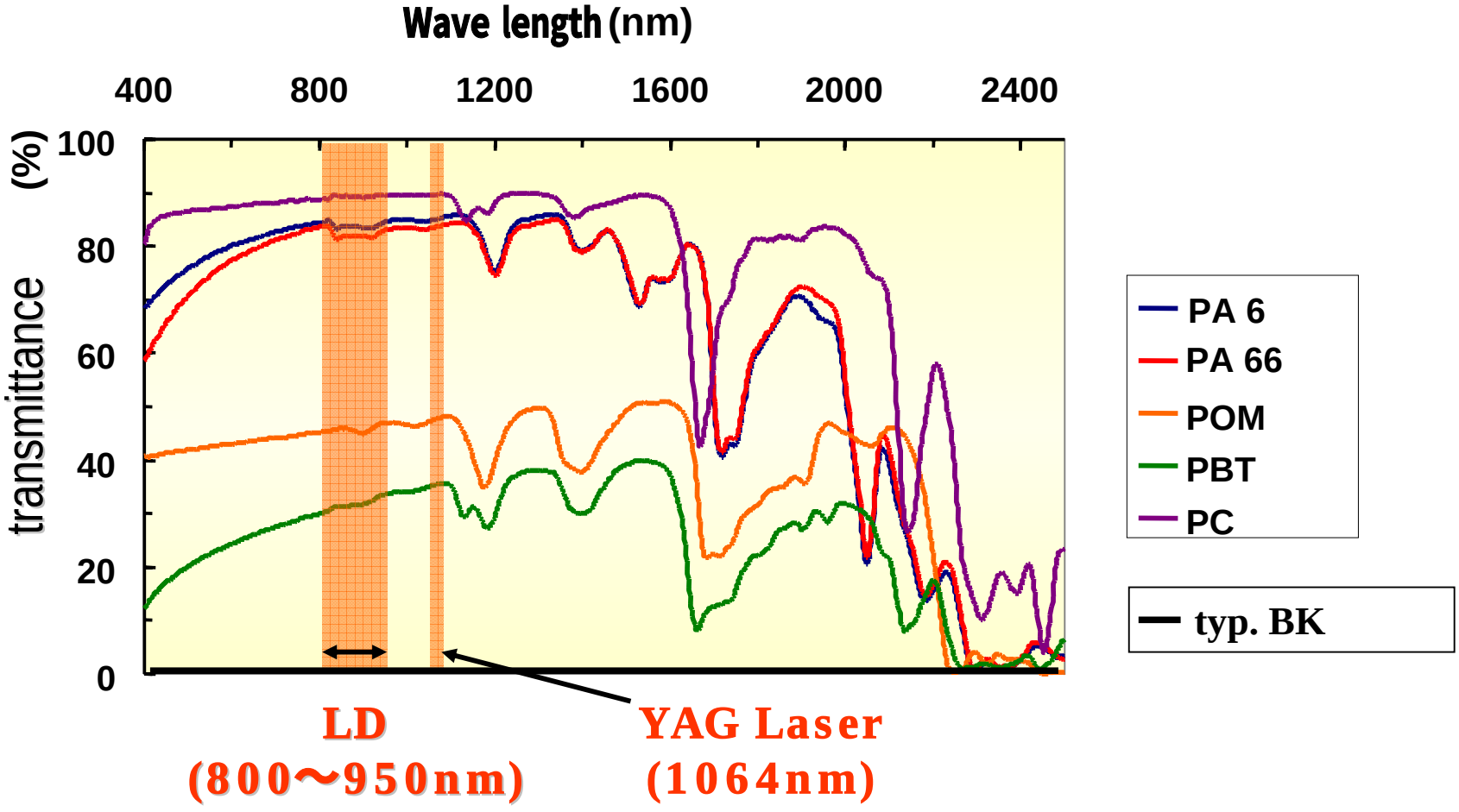
Du Pont Development Approach



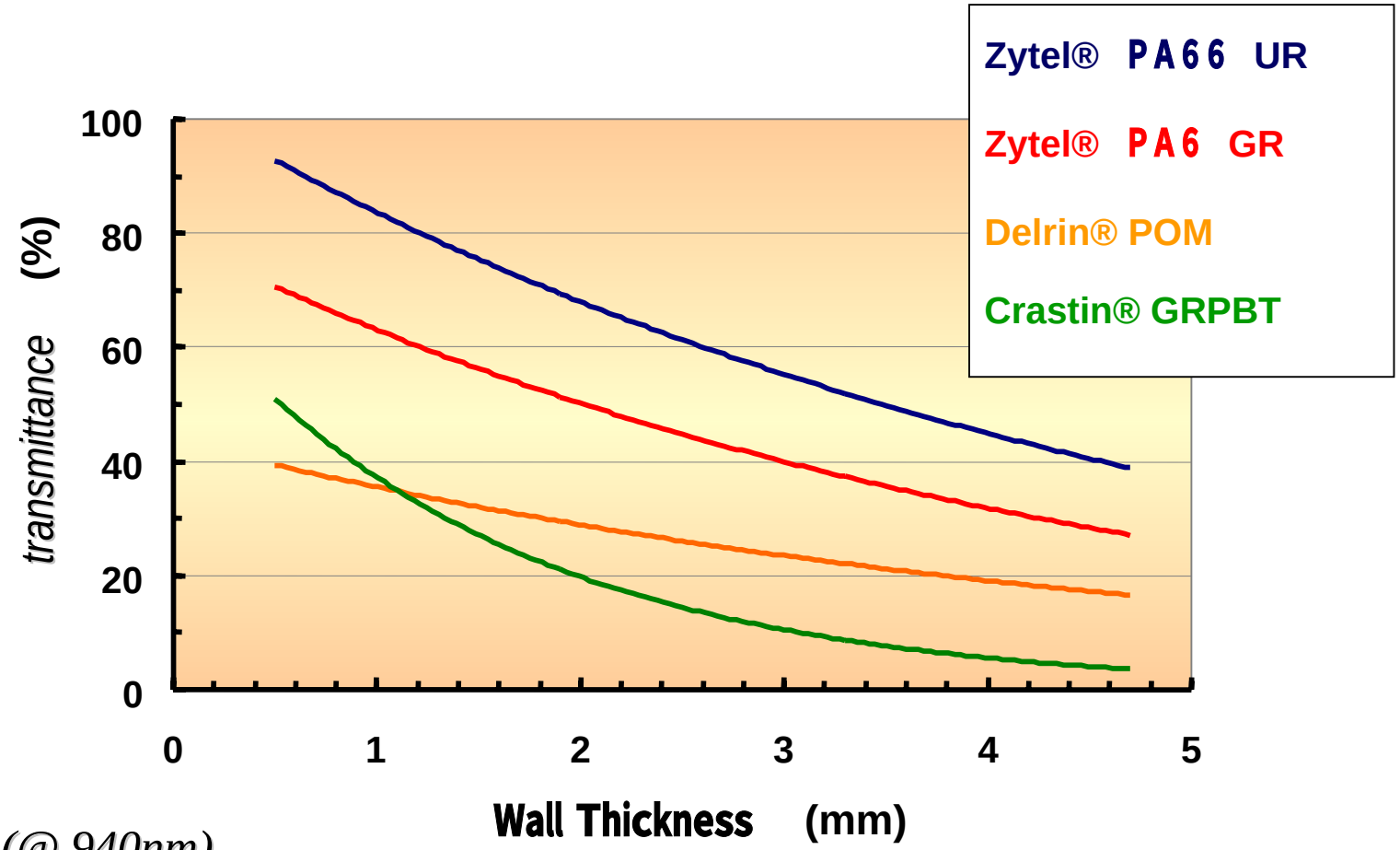
Considerations for polymer laser welding optimization

- **Materials**
  - Transmittance：Polymer，Pigment，Additives
  - Absorbent：Polymer，heat gen./melt，Pigment
- **Design**
  - Wall thickness，Basic part geom，Joint design
- **Molding**
  - Warpage/Sink mark
- **Welding process**
  - Power，Speed，Cycle time，Focus spot

Transmittance & Absorbent relation between the polymer & Laser light

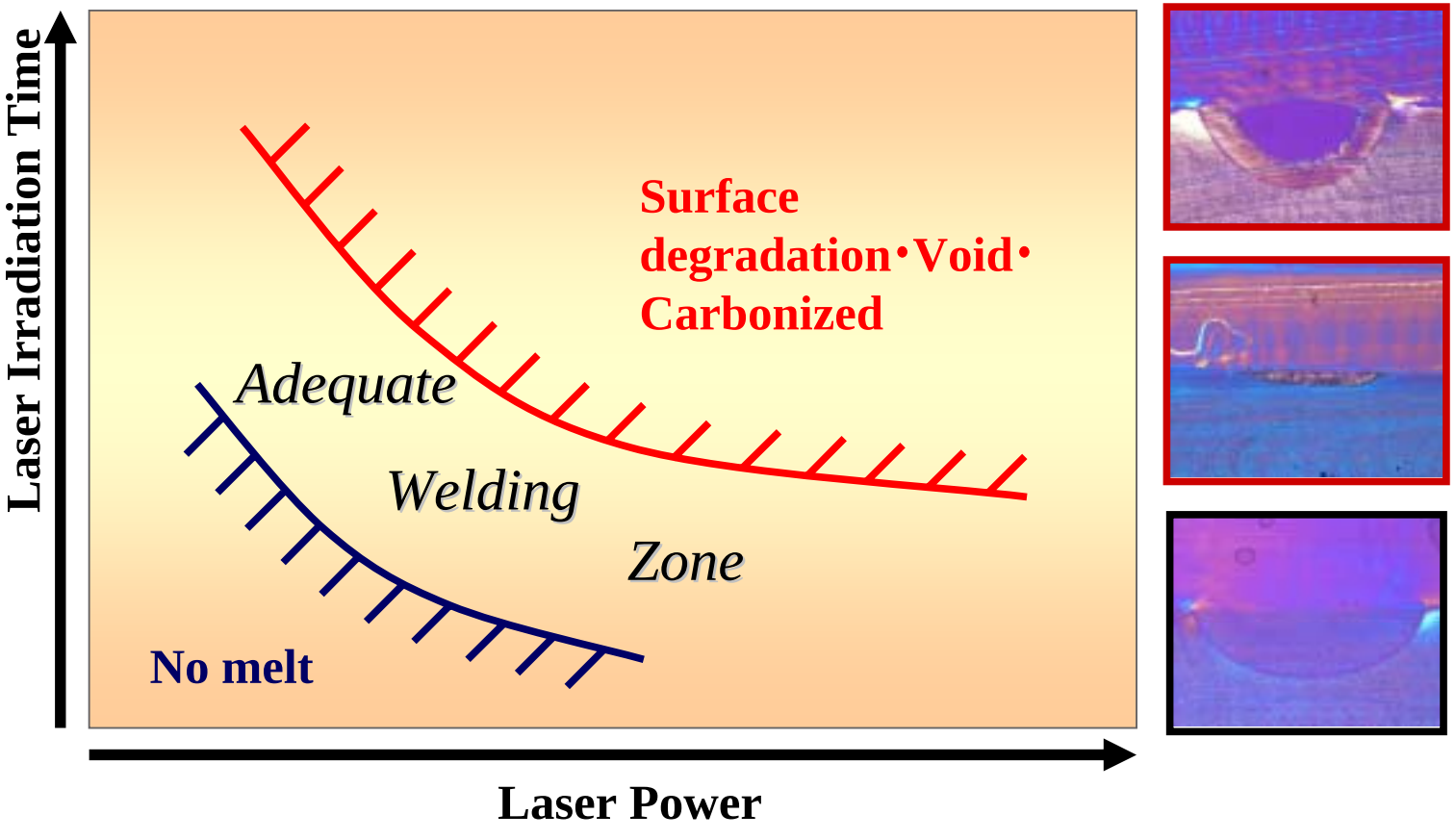


Material / Wall Thickness & Transmittance

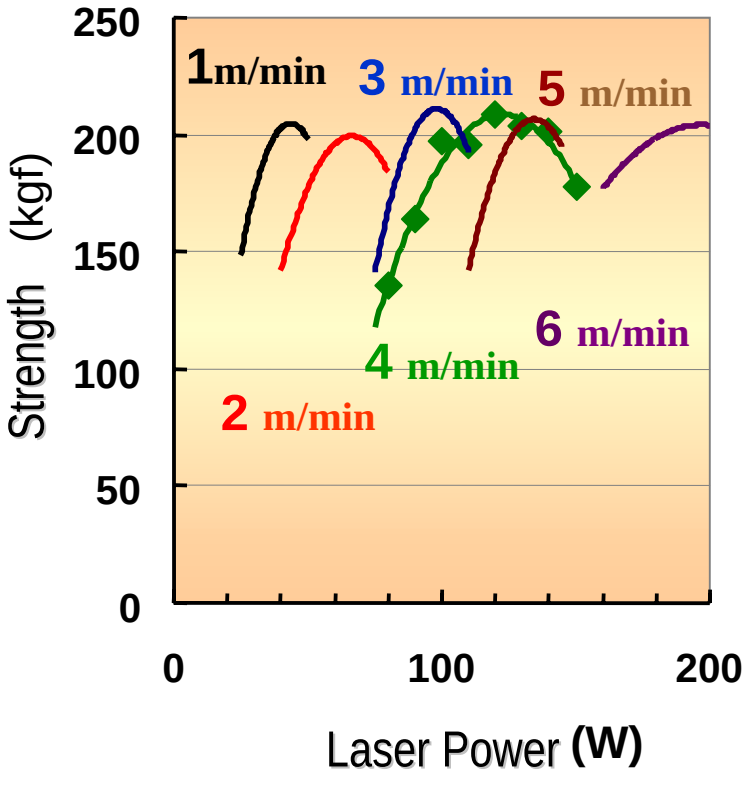


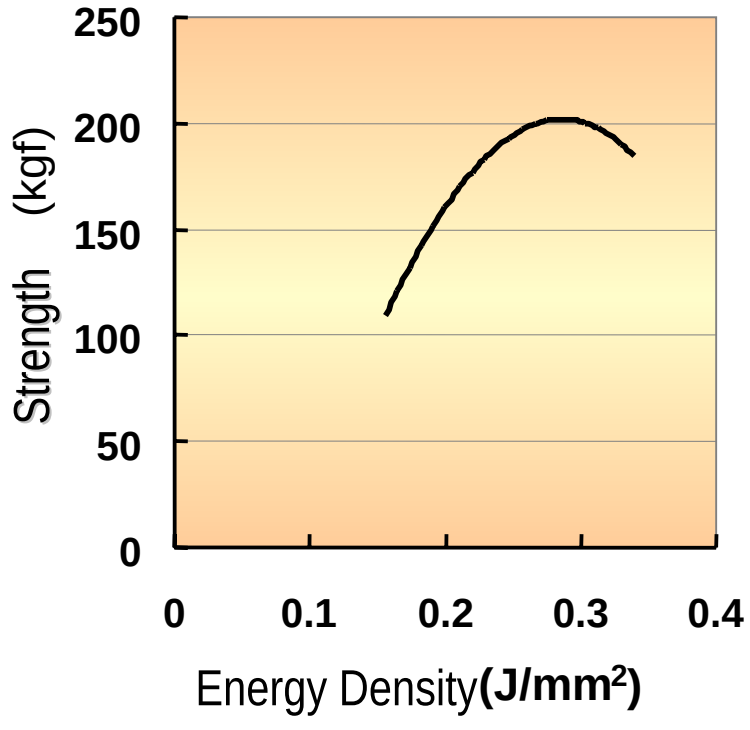
(@ 940nm)

Polymer Laser Welding Optimization - Laser Power & Irradiation Time



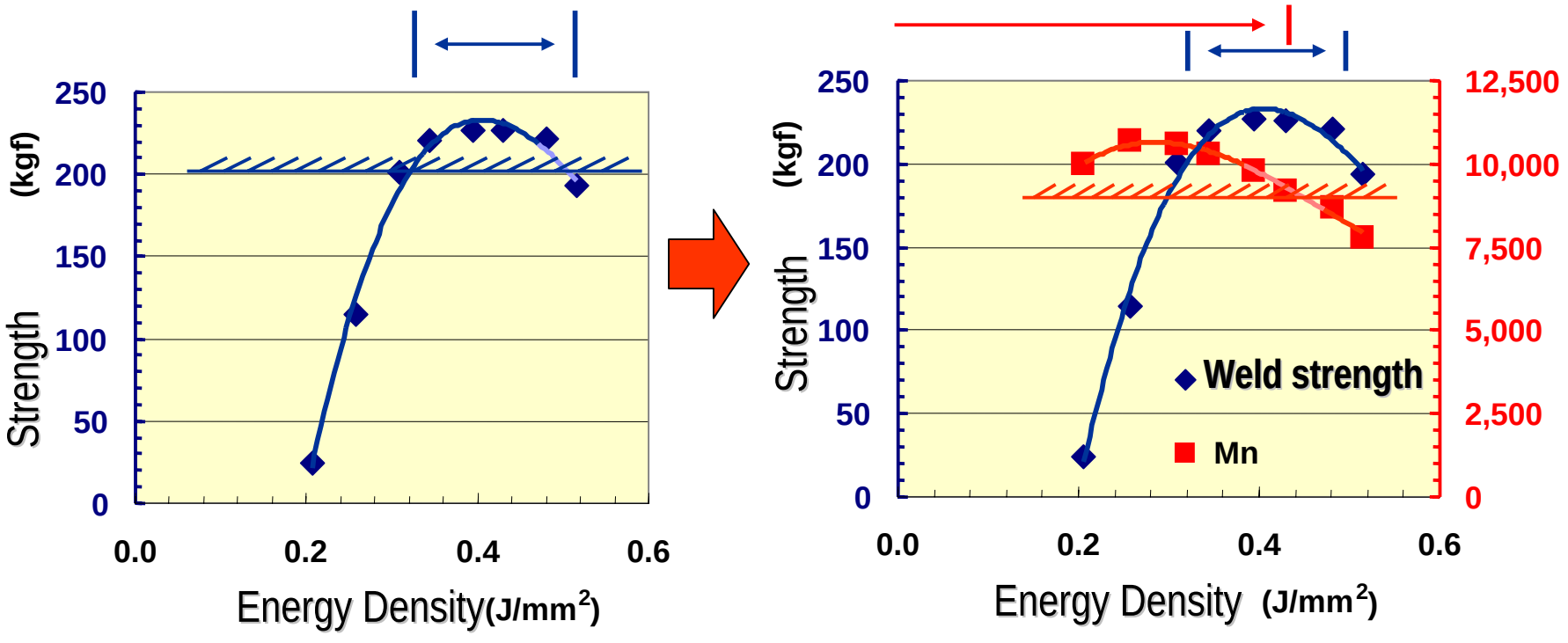
Polymer Laser Welding Optimization - Productivity ;Speed & Power





(Zytel®HTN51G35HSL)

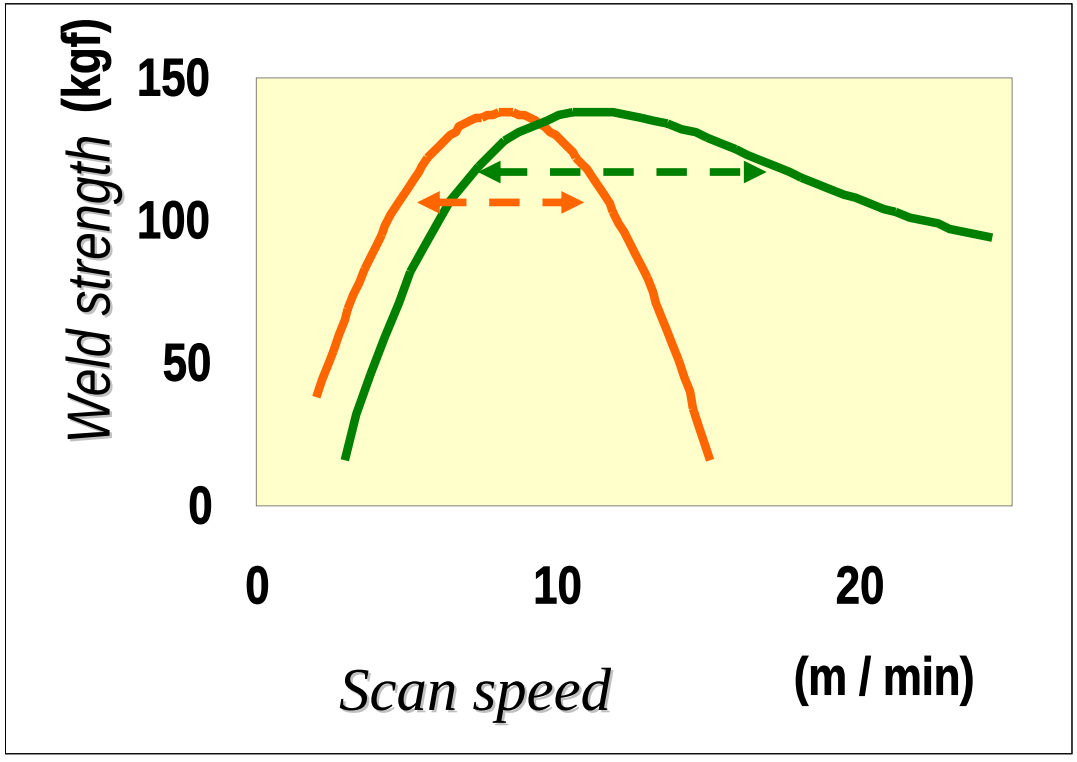
Polymer Laser Welding Optimization - Mn



HTN51G35HSL NC + BK (2mm ovlp TP)

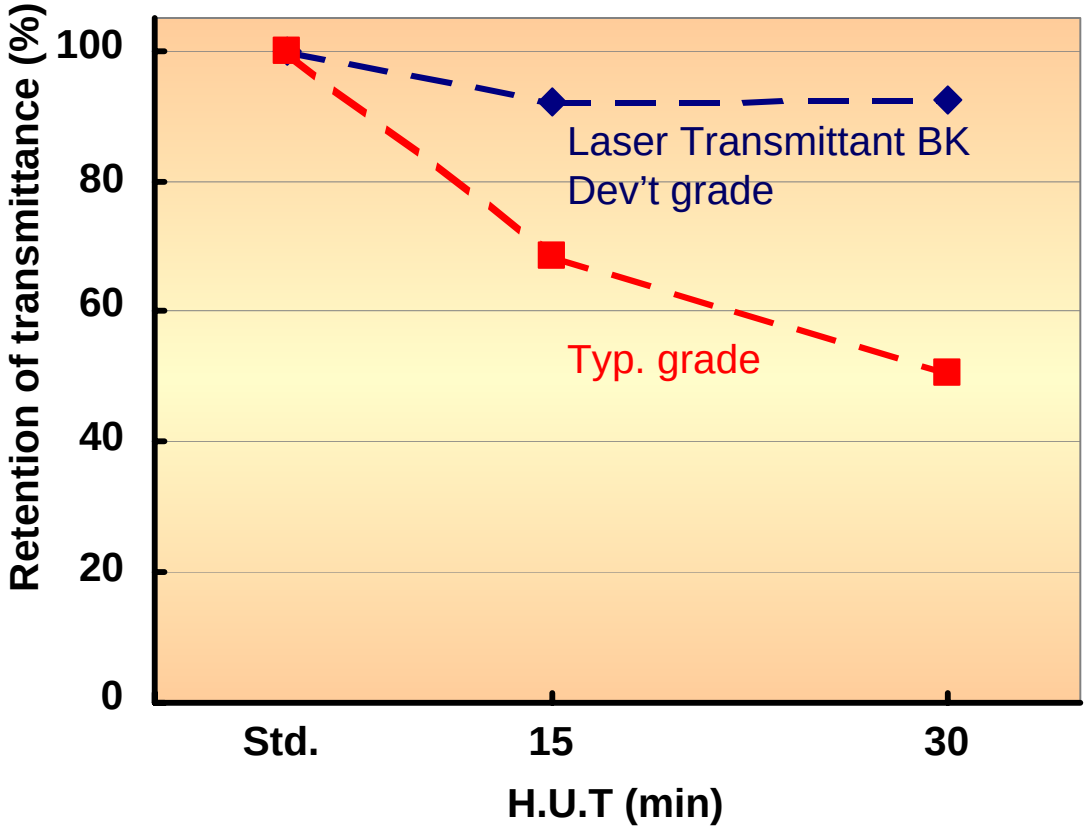
Polymer Laser Welding Optimization - Absorbent material

- ***Process Window***

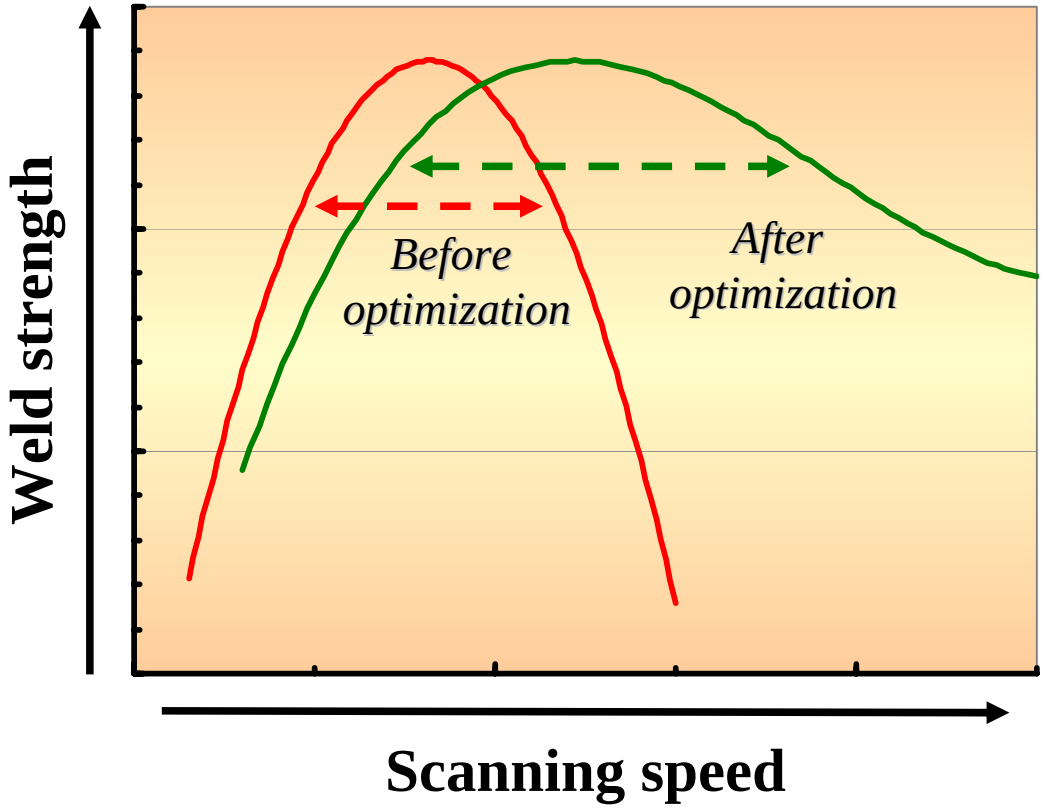


Power (W) : constant

Polymer Laser Welding Optimization - Moldability



Polymer Laser Welding Optimization - Process Easiness



LASER Welding Assembly - Case Study

Door Lock actuator

Customer: Hella

Zytel® 73G15 NC
Minlon®FE260001BK

Camshaft position sensor

Customer: Delphi

Zytel® LT 74G33HSL BK
Zytel® 74G33 HSL BK

Leakage Test Sensor

Customer: Bosch

Crastin® SK603 NC
Crastin® SK603 BK

LASER Welding Assembly - Case Study

Gearshift housing

Daimler Chrysler

Zytel® 70G30 NC
Zytel® 70G30 BK

Trap Canister

ASIAN Kogyo

Zytel® 103FHS NC
Zytel® FE110003 BK

Cost reduction on production (faster production cycle),
More design freedom, precise positioning, no flash

Development Support As a Total Solution

- **DESIGN/CAE support for proposed basic geometry**
  - minimize mold deformation & sink mark
- **Propose adequate material selection**
  - Including optimized pigment and heat stabilized
- **Collaborate with system supplier & pigment supplier**
- **Development support for production facilities**
- **Development support by utilizing various TP and co-relate to the real applications**
- **Total development coordination for on-line monitoring & quality assurance**

EP Material & LASER welding

PA **POM**

- **LASER *Weldable***
- **NC Possible to use as Transmittance side**
- **BK Possible to use as Absorbent side**

FR

- **No transmittance (some exceptions)**

PET/PBT/PCT

- **LASER *Weldable* but, difficult than PA/POM**
- **NC Possible to use as Transmittance side**
- **BK Possible to use as Absorbent side**

MR

- **No transmittance, cannot use T side**
- **BK Possible to use as Absorbent side**

LCP

- **No transmittance, cannot use T side**
- **NC/WT**
  Possible to use as Transmittance side
- **BK Possible to use as Absorbent side**

GF/Impact resistance

- **LASER *Weldable***
- **but,PBT/PET is rather difficult than PA/POM**

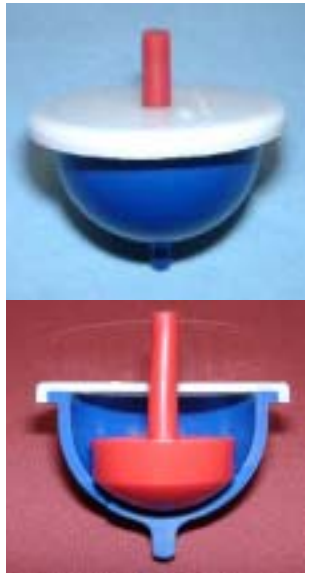
Du Pont various test pieces

Box: warp/corner
Burst/tensile

Sphere: Burst

T-joint
Tensile

overlap
Shear



"Koma"
Burst
Pure tensile

Global Technical Link & technical support

EU ETC

JPN UTC

US. ATC

Contacts: DuPont & System Suppliers :

- DuPont Korea : Byung-Gul Ham
  Engineering Polymers -TEL *+82-2-2222-5377*
  http://plastics.dupont.com

****

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  -TEL +82-2-529-8910
- (**Parker Corporation) ;**
  -TEL
- **Branson Korea Co., Ltd. : YOO, Jae Du**
  -TEL +82-31-422-9572
- **Miyachi Korea Corporation : PARK, Seung-Kwo**
  -TEL +82-31-707-5855

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