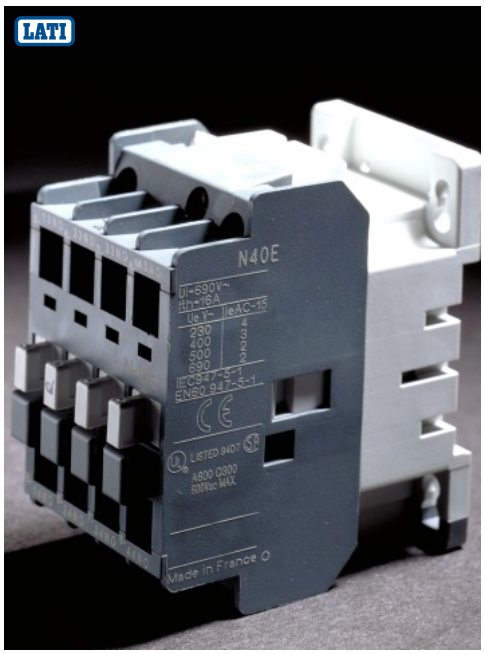
Laser Marking on Thermoplastics

Key benefits:

- **It provides permanent, wear - and abrasion - resistant marks;**
- **It allows for precision, repeatability, and remarkable process versatility;**
- **It is an environmentally friendly alternative to traditional methods in so much as laser marking requires no hazardous inks;**
- **It eliminates multi-step process tooling;**
- **It is also non-contact and non-obtrusive marking, so it is ideal for sensitive materials and delicate parts;**
- **It allows fast cycles and short operation start-ups.**



Example of Laser Marking on a contactor

Different effects occur when a laser beam engraves a thermoplastic material and some of these effects are not completely understood. What is clear is that the interaction between the laser beam and the thermoplastic compound depends upon several factors and therefore results are different.

The necessary condition for laser marking is the absorption of the laser beam energy resulting in a colour change or similar effect. This may be achieved by interaction with the polymer alone or through the addition of pigments and / or additives.

Most non-pigmented thermoplastics (in their natural colour) are not readily laser markable, because they do not absorb the laser light (wavelength 1064 nm for standard Nd:YAG lasers).

Thermoplastics in their uncoloured or natural state can be roughly divided into three categories according to their laser markability:

1 Thermoplastics with good absorption and carbonisation, resulting in an extensive darkening of the laser-exposed areas. Examples include PES, PSU, PC.

2 Thermoplastics with inconsistent absorption and carbonisation, resulting in an uneven marking (pearl-chain effect). Examples include PS, SAN, ABS, PET, PBT. However, if a suitable pigment or special additives are incorporated, these materials can be marked more uniformly, and high-quality marking can be obtained.

For both the a.m. groups, optimisation of the pigment / additive package for dark backgrounds can yield a light marking, usually off-white in colour.

3 Thermoplastics with low or negligible absorption. This group includes PA, POM, PP, PE. In their natural, uncoloured state, they are not laser markable. With the addition of an optimised pigment system, it is possible to obtain an almost white marking result on dark or black colours. Some of these plastics when pigmented light in colour yield only a similarly light marking, but with special additives, a dark print may also be obtained.

Laser markability can be greatly influenced by fillers, reinforcements, processing aids, flame retardants, and other additives. Contrary to popular belief, the addition of glass fibres to a polymer reduces its markability only slightly. In addition, some fillers and / or flame retardants may reduce the laser markability due to their inherent colour. On the other hand, the additives contained in some flame retardant packages can have a positive effect on the contrast with laser marking.

LATI is willing to share with you its expertise in this field, and its Technical Service and Research & Development Teams are at your complete disposal to analyse your requirements and collaborate on project developments.

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LATI Basic Considerations

A) Two main **Marking Techniques:**

- **Photo Masking** *(typically with CO_2 and EXCIMER Lasers)*
  - Very rapid
  - Not flexible
- **Beam Steering** *(typically with Nd: YAG Lasers)*
  - Lower speed
  - Very flexible

LATI Basic Considerations

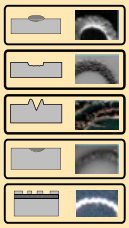
B) Four main types of **Laser**

Type of laser	Wavelength (nanometres)	Power
CO_2	10640 nm	10-120W max, 6J/pulse when marking
Excimer	175-483 nm	Max 2 J/pulse when marking
Nd:YAG	1064 nm	25-100W, 0.2 J/pulse when marking
Nd:YAG double frequency	532 nm	1-3W

LATI Basic Considerations

C) Several possible **Interaction Effects** between Laser and Thermoplastics:

- **Foaming**
- **Engraving without color change**
- **Engraving with color change**
- **Colour change or bleaching**
- **Coating removal**



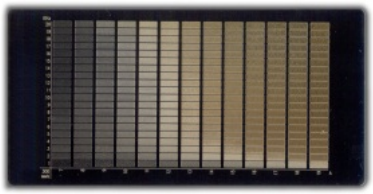
LATI Basic Considerations

D) Key **Parameters** affecting **Quality** of Laser Marking

- **Laser Wavelength**
- **Focused Spot Size**
- **Pulse Rate and Peak Pulsed Power**
- **Beam Velocity (Marking Speed)**
- **Thermoplastic Composition** (polymer, fillers, additives, pigments)

Families in LATI product range that can be Laser Markable, dependent upon specific formulations:

LCP	**LAXTAR**
PPS	**LARTON**
PES	**LAPEX A**
PPSU	**LAPEX R**
PSU	**LASULF**
PEEK	**LARPEEK**
PP	**LATENE**
PA 6	**LATAMID 6**
PA 66	**LATAMID 66**
PA c	**LATAMID 68**
PA 12	**LATAMID 12**
PBT	**LATER**
PTT	**LATER T**
POM	**LATAN**
SPS	**LAESTRA**
ABS	**LASTILAC**
SAN	**LASTIL**
PC	**LATILON**
PPOm	**LARIL**
PBT/PC	**LATIBLEND 7587**
ABS / PC	**LASTILAC 10**



Laser Marking appearance effect as a function of the Marking Process Parameters

A selection of LATI Products with Good / Fair Quality Marking in terms of Contrast & Definition (with or without specific additives)

Note: should you be interested in receiving a more detailed brochure, just contact our Offices