Automatic Hypotube Coating Removal System

Laser Micro Machining system with bulk feeder for small diameter tubes and fine wires

KEY FEATURES

- Modular system, adaptable to the product requirements
- Wide range of lasers available for extensive portfolio of laser micromachining processes
- Linear feed and rotation (simultaneous if desired) for processing surfaces, turning tubes to process 360 degrees, achieve spiral cuts and other free forms
- Automatic system that delivers 24/7 high quality products, fully independent from operator performance and experience
- Class-1 laser safety enclosure fulfils all CE and CDHR requirements
- IMS3000 (Integrated Manufacturing Software) for integral programming of all processing parameters like laser settings, CNC settings, vision, operator work instructions, etc.
- Advanced FDA/Mil-Spec compliant data logging option
- Integrated remote services and remote diagnostics option

DESCRIPTION

Laser processing is a technology that produces faster, cleaner, more accurate and effective removal of a variety of coatings on round and cylindrical components; such as hypotubes and guide wires. This MIYACHI EAPRO system is designed for bulk processing of these medical parts which typically have the form of round wires, tubes and rods. Diameters range from 50 microns to 2mm and typical lengths from 100 up to 3000mm.

The system may also be used for advanced surface treatments, including discolouration, foaming and darkening or annealing. By selecting the correct laser source and part feeder, most plastic and metal parts that are fed as a bundle or on a reel may be laser processed.

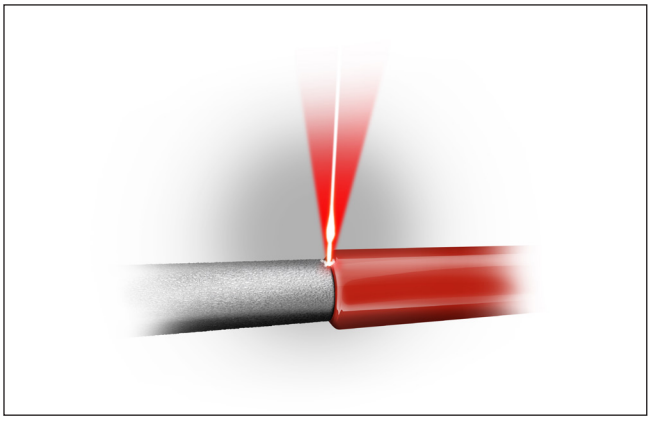
The laser process creates a cleaner cut with smoother edges when compared to more traditional methods such as grinding. It eliminates burrs, nicks and does not result in increased surface roughness of the metal beneath the coating; if so desired. In addition, this process leaves a much cleaner surface after processing. The result being a cleaner, smoother, safer and more precise ablation window. This system will improve production processes, enable higher throughput levels and accommodate a wider range of materials.

The laser processing can remove a range of biomedical coatings. This can be hydrophobic coatings such as PTFE, silicone, hydrophilic coatings (silicone based coatings) and thermoplastic elastomers (TPE) including Nylon. Nylon coatings are known under their trade names Zytel®, Rilsan®, Grilamid®, Vestamid®, Pebax®. Also Nylon 12 materials known under the trade name Grilamid® L25, Rilsan® A, Vestamid® can be processed with a laser.

GUIDE WIRE PROCESSING

Guide wire components are available in a variety of diameters and base materials for coated core, coiling and coiled wire, including round or flat; stainless steel and nitinol. PFOA-free PTFE and hydrophilic coatings are available. In addition, coated guide wire components are produced in a variety of forms, such as spooled, straightened, cut to a specific length or coiled.
The laser ablation process provides greater flexibility in locating the areas of coating removal, allowing our customers to design more complex devices and gain a competitive advantage over other manufacturers.

TYPICAL APPLICATIONS



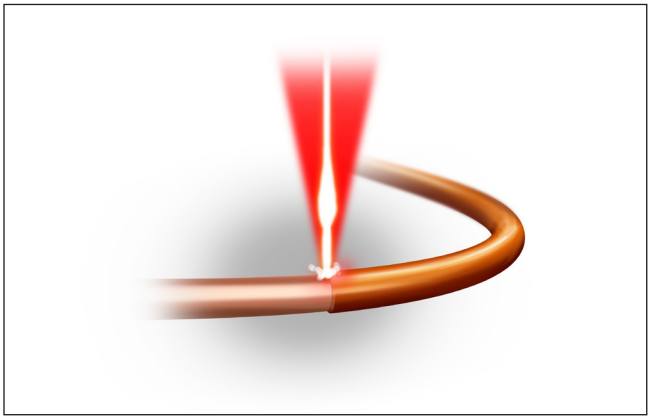
Coating Ablation & Surface Roughening

LAYER/COATING REMOVAL

The laser energy is used to evaporate, melt or oxidise the existing layer. The laser can also be used to make a defined cut in the layer to enable easy removal of the layer, either by hand or automated.

OPTIONAL SURFACE ROUGHENING

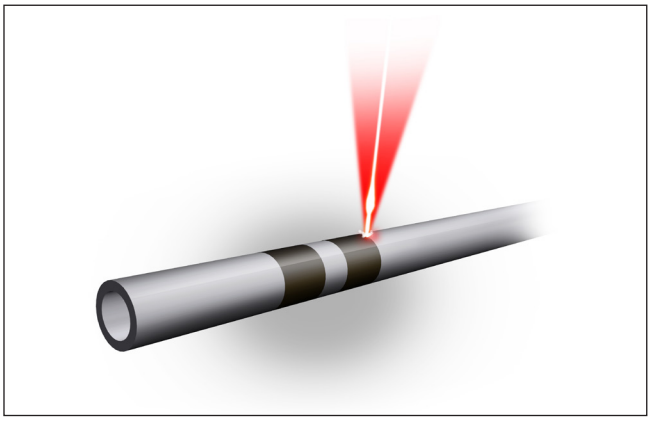
In addition to layer removal, the system can be used to roughen the surface. This can be useful to increase the adhesion for adhesives, increase the friction for handling, etc.



Kapton Removal for electrical contacting

KAPTON REMOVAL

Electrical isolated wires can be stripped by ablation of the kapton. The kapton absorbs certain wavelength of laser light effectively, leaving a clean metal surface for electrical contacting afterwards.



Marker Band Annealing
Darkening or polishing of metals

MARKER BAND ANNEALING

Many hypo-tubes are annealed before the coating is applied. This can discolour the metal and make it slightly brown. This oxide layer may be removed using the laser to bring the metal surface back to a bright shine. Alternatively the laser can also be used to darken the metal so a clear contrast is apparent.

OPTIONS

- Automatic OK/NOK selection for output bin
- Vision based wire diameter measurement
- Automatic wire length measurement
- Advanced pattern recognition algorithms
- Part diameter check, available for both pre- and post ablation
- Several feeder options available incl. bundle feeders, spool/bobbin feeders to feed thin to medium diameter materials
- Several out feed possibilities: a passive storage, a section with OK /NOK part separation, winding to a coil/ bobbin, cutting thin wires to a specific length, etc.
- High accuracy motion system
- Cleanroom compatible system
- Integrated fume extraction & filtration system options
- Automatic polishing of the hypotube tip in the post ablating process.

SELECTING THE RIGHT LASER FOR WIRE STRIPPING

Laser type	Process attributes
Sealed CO_2	Absorbed well by all polymers Absorbed poorly by metals Highly thermal removal process is suited to larger wire diameters
Nanosecond Nd:YVO_4 532 nm and 355 nm	Absorbed well by most, but not all polymers Short pulses enable high control of removal Ablation material removal minimizes heat input Well-defined edges
Picosecond and femtosecond lasers	Best quality removal and edge definition Cold processing with no heat input Can potentially remove indivdual layers of coextruded polymers

ML-7320D 1070nm Q-SWITCHED NANOSECOND Yb:FIBER LASER

This laser is a cost-effective package for generic laser processes that run at 1060-1070 nm wavelengths. The programmable waveforms allow a wide range of possibilities to develop the ideal process for your application.

TECHNICAL SPECIFICATIONS 1070nm LASERS

Laser type	ML-7320D
Wavelength	1060-1070 nm
Max. average power	20 W
Power setting	10-100 %
Freq. range full power	25-1000 kHz
Max. pulse energy	0,8 mJ
Max. peak power	12 kW
Pulse duration	10-200 ns
Typical beam quality (M^2)	1.8
CW mode	Yes, with modulation 0-200 kHz
Beam expander / collimator	F75 standard
Output lens	160 mm standard
Typical spot size	55 microns
Upon request this laser is available with a variety of alternative engines	

TECHNICAL SPECIFICATIONS OPTIONAL ENGINES 1070nm LASERS

	Optional engines for ML-73xxD
Max. average power ranges	10 to 100 W
Max. pulse energy	up to 1,2 mJ
Max. peak power	up to 20 kW
Beam quality (M^2)	From <1.3 to 3.5
Pulse duration	3 to 500 ns
Beam expander / collimator	Fixed or exchangeable in several magnifications/ focal distances
Focal distance output lens	Exchangeable 80-420 mm
Spot size range	25-1000 microns

TECHNICAL SPECIFICATIONS GALVO HEAD 1070nm LASERS

Marking Speed	>5,0 m/s
Positioning speed	>9,0 m/s
Resolution	12 µrad
Repeatability	20 µrad
Maximum gain drift per axis	0.005 %/K
Maximum offset drift per axis	30 µrad/K
Long term drift over 8 hours	<300 µrad

355nm Q-SWITCHED PULSED NANOSECOND UV LASER

The UV laser is a versatile laser for ablation processes. The short pulses in combination with the short wavelength give an effective material removal process on most materials.

TECHNICAL SPECIFICATIONS 355nm LASERS

Laser type	Q-switched Nd:YVO_4 laser
Wavelength	355 nm
Repetition rate	1 Hz - 300 kHz
Average power at 30 kHz	> 4 W
Pulse energy	at 1 kHz > 100 µJ, at 30 kHz > 130 µJ
Pulse width	at 20 kHz < 15 ns, at 100 kHz < 30 ns
Energy stability	2% rms
Beam profile	TEM00 M^2 < 1.2

TECHNICAL SPECIFICATIONS GALVO HEAD 355nm LASERS

Beam expander	X10
Aperture	9 mm
Mirrors	coated Si
Wavelength	355 nm
Objective	F-theta
Field size	56x56 mm

10604nm 30W CO_2 LASER

The longer wavelength of the CO_2 laser is found to be beneficial for specific applications, like processing organic materials. Good results have been achieved with ablation of isolating layers like kapton (polyimide).
The laser gives a near-perfect, circular beam which can be focused to the smallest possible spot size, therefore creating the highest possible energy density on the work surface. This results in the fastest processing speeds and the highest possible resolution and accuracy.

TECHNICAL SPECIFICATIONS 10604nm LASERS

Laser type	CO_2
Wavelength	10604 nm
Output power	30 W
Beam quality (M2)	<1.2
Rise time	<100 µsec
Typical beam diameter	2.5 mm

TECHNICAL SPECIFICATIONS GALVO HEAD 10604nm LASERS

Lens	80 mm focussing distance 125/200/370 mm optional
Field size	27x27 mm
Typical depth of field	+/- 0.4 mm

1025nm FEMTOSECOND LASER

The femtosecond laser is also known as “cold laser processing”. The energy pulses are so short (10^{-15} second), that the material dissolves / evaporates completely without any thermally effected zone. Although it comes as an investment premium, it is the ideal energy source for a range of applications.

TECHNICAL SPECIFICATIONS 1025nm LASERS

Laser type	Femto second diode-pumped thin-disk laser
Wavelength	1025 nm
Max. Power	4/ 5 W
Pulse length	<400 fs
Max. Rep. rate	500 kHz
Max. Pulse energy	40 µJ

TECHNICAL SPECIFICATIONS

Guidewires/ Hypotubes Feed System	
Dimensions	(WxDxH) 3000 x 1000 x 1000 mm
Pickup method	vacuum or magnetic
Hypotube diameter range	0.2 to 2 mm
Hypotube length	max. 2000 mm (other lengths upon request)
Coiling Material Feed System	
Dimensions	(WxDxH) 1000 x 1000 x 1000 mm
Feeding	coil or bobbin, 6 to 150 mm diameter
Wire diameter range	50 to 500 microns
Guidewires/ Hypotubes Feed-out unit	
Dimensions	(WxDxH) 2500 x 1000 x 1000 mm
Hypotube diameter range	0.2 to 2 mm
Hypotube length	max. 2000 mm (other lengths upon request)

WEIGHT & DIMENSIONS

Overall Standard Dimensions	
Dimensions	(WxDxH) 1000 x 1000 x 2000 mm (Excluding in and out-feed sections)
(WxDxH)	3000 x 1000 x 2000 mm for coiled materials
(WxDxH)	7000 x 1000 x 2000 mm for 2000 mm guidewires/hypotubes
Active part height (for engineer / operator interference)	indicatively 950 mm
Table height adjustment	+/- 80 mm
Weight	indicatively 400 kg