

Cascade Laser Components & Systems: Technology and Market trends

Release announcement

TEMATYS is pleased to announce the release of its new market and technology report "Cascade Laser Components & Systems: Technology and Market trends".

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Abstract. Today, advances in cascade lasers (CL) are revolutionizing infrared spectroscopy and OEMs can count on two mature alternatives: interband cascade lasers (ICLs) that are expected to be a cost killer in the 3-6 μ m spectrum and quantum cascade lasers (QCLs), with more power and a continuous wider spectral resolution from 3 to 300 μ m. New CL-based applications are launched every day. The market is getting mature with strong players for driving applications like: industry (Vertex70 from Bruker), environment, life science (Spero from Daylight Solutions) or transports (Mexa-1400QL-NX from Horiba). Our study is a qualitative and quantitative market analysis of the CL technologies and applications.

The first quantum cascade laser was invented 20 years ago and demonstrated at Bell Labs in 1994 by Faist et al. When analyses need rapid measurements, cost effective monitoring and miniaturization, tunable semiconductor lasers are perfect sources, thanks to their outstanding characteristics. Indeed, application fields like environmental gas analysis or industrial process control are now taking advantage of tunable semiconductor lasers for leaving the laboratory and enabling on-field testing.

Today, advances in cascade lasers (CL) are revolutionizing infrared spectroscopy and OEMs can count on two mature alternatives: interband cascade lasers (ICLs) that are expected to be a cost killer in the 3-6 μ m spectrum and quantum cascade lasers (QCLs), with more power and a continuous wider spectral resolution from 3 to 300 μ m. New CL-based applications are launched every day. The market is getting mature with strong players for driving applications like: industry (Vertex70 from Bruker), environment, life science (Spero from Daylight Solutions) or transports (Mexa-1400QL-NX from Horiba).

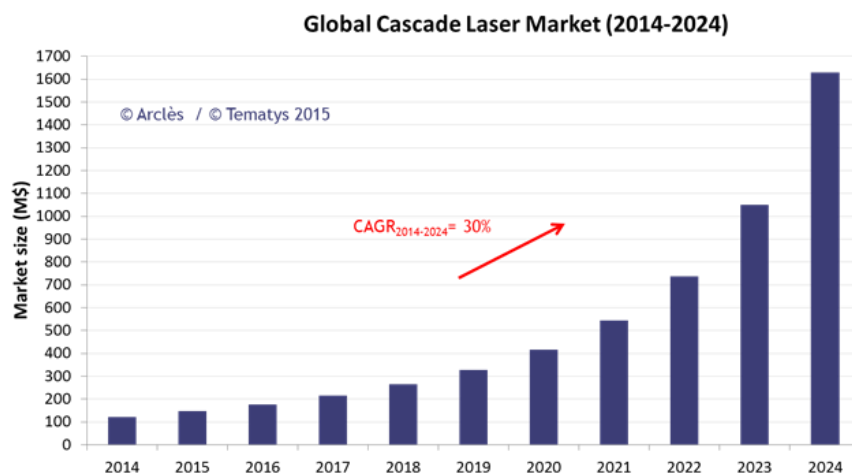
The first CL-based systems for applications outside research labs were sold in the 2000's. Now, the Cascade Laser (CL) market is expected to grow from 148M\$ in 2015 up to 1.7B\$ in 2024 with a strong CAGR increase due to the maturation of commercial products using CL components. CL-based systems for spectroscopy or imaging are still expensive (often above 50-100 k\$) compared to existing technologies (UV, NIR...) despite around 4000-5000 CL sources are sold yearly in 2014-2015.

Multigas detection for industrial applications is expected to be the biggest market for the next 5 years. However, transports and healthcare applications are expected to take off and become the

biggest markets in longer terms, representing more than 50% of the total business. In healthcare, CLs sources are a key component for Point-of-Care devices. In transport, the 3 main applications will be: exhaust analysis for engine design and certification; vehicle emissions monitoring and jet fuel control.

Our study is a qualitative and quantitative market analysis of the CL technologies and applications. It shows that the improvements of components performance, like micro-spectrometers, along with the progress of infrared laser spectroscopy will drive the CL market growth. We compare the different CL technologies, we identify the specific detectors of each spectral domain and their use either as continuous or pulsed sources. In addition, CL technologies allow today to be extended to new applications such as active or passive imaging applied to microscopy for example.

The report provides extensive market data in M\$ from 2014 to 2024 for different applications: Industry, Security & Defence, Environment, Health Care, Transports.



CL Technology is Mature and is Already a Business

The CL market is a young market. The CL based first systems were sold in the 2000's. Currently, the MIR spectrum is more and more adopted as it enlarges the capabilities of spectroscopy.

CL technology, thanks to its narrow linewidth and good wavelength tunability, is suitable for applications like industrial sensing: explosives or chemical detection; or light sources for IR imaging systems, medical diagnostic and spectroscopic applications.

Today, the segments industry, environment and transports are the most mature and the biggest ones, while the military applications represent by far the biggest part of the security and defence application market.

© Arclès / © Tematys 2015 Functionalities

Applications	Control	Analysis	Monitoring	Safety	Imaging	Transmission
Industry	✓	✓	✓	✓		
Security & Defence		✓	✓	✓	✓	✓
Environment	✓	✓	✓			
Health Care		✓		✓	✓	
Transports	✓	✓	✓			

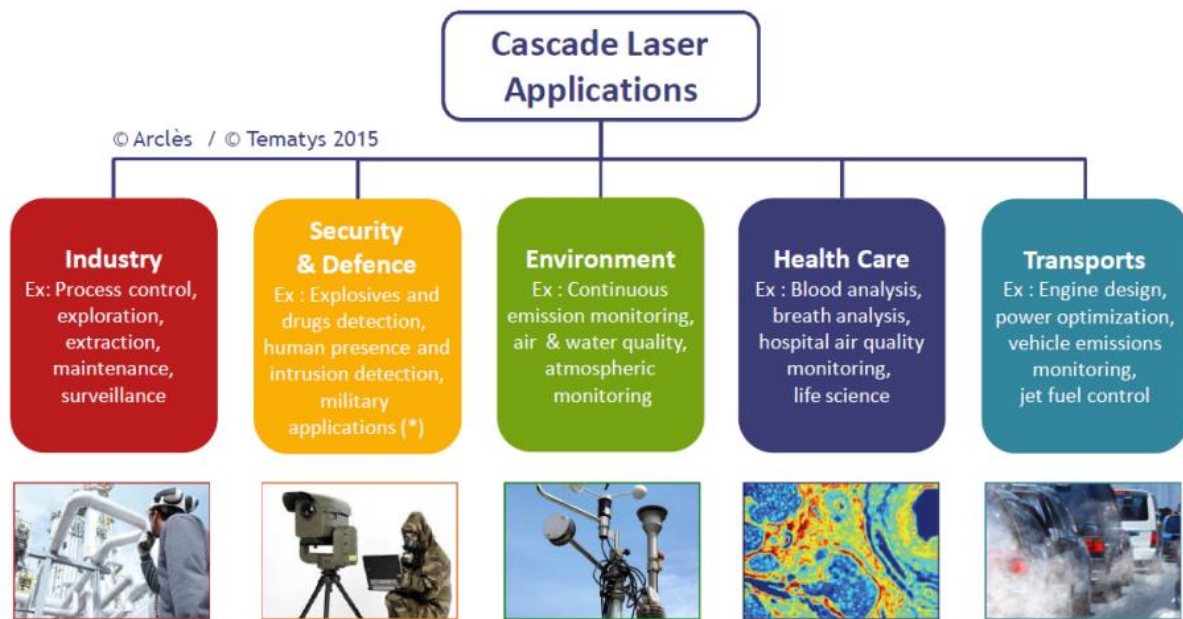
CL sources are well suited to fulfil the increasing need for high highly miniaturized contactless technologies which should show the following features: high sensitivity, low integration cost, ease of use, high repetition rate, very small size, ATEX compatibility.

Several spectroscopy techniques exist (direct absorption spectroscopy, modulation spectroscopy), but still need to be industrialized and fully characterized for certification issues in some applications.

The need for high performance detection in many fields is a great opportunity for Cascade Laser technology

MIR spectrum enlarges the adoption of spectroscopy along with NIR and UV-VIS and CL sources are is becoming a new competing technology for spectroscopy, imaging and transmission applications.

This report provides a study of CL components, systems and application markets. It evaluates the potential and the challenges to be faced in more than 25 market segments. It also provides an application roadmap for the next decade.



Keywords: quantum cascade laser, interband cascade laser, spectroscopy, industry, security, environment, health care

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About TEMATYS (www.tematys.com)

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Infrared Imaging Photodetectors and Systems: Technology and Market Trends (2015)



Photonics Technologies for ADAS in the Automotive Industry (2015)

Optical Coherence Tomography for Healthcare and Life Science (2014)



Terahertz Components & Systems, Technology and Market Trends (2013)

Biophotonics Market, technologies and Markets Analysis (2013)

