



High-Performance Chemiluminescence Analyzer Series

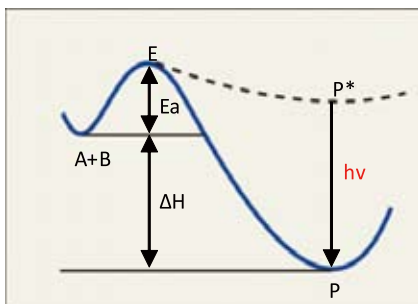


Tohoku Electronic Industrial Co.,Ltd.

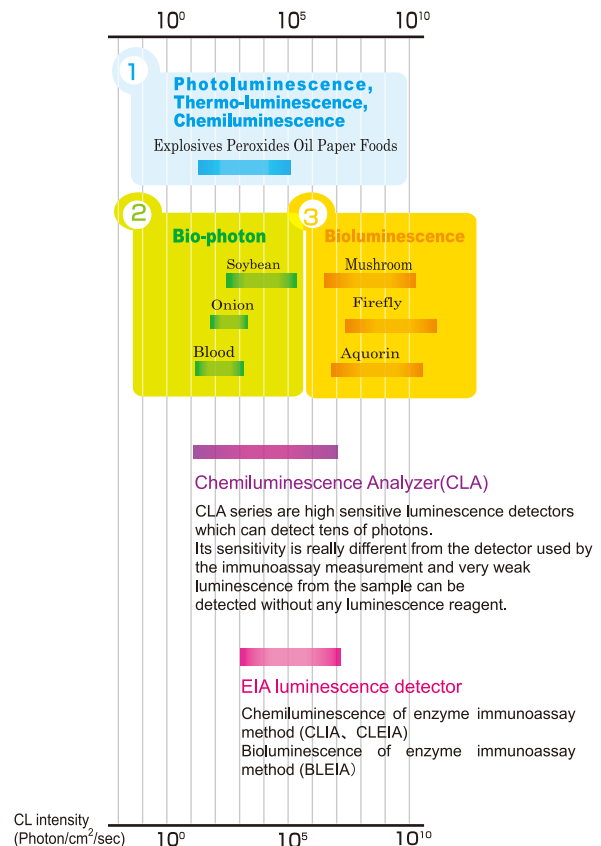
What is Chemiluminescence ?

Our surroundings are characterized by an abundance of light. Light detectable by the human eye ranges from strong such as sunlight and fireworks to weak such as fireflies and stars. In addition, there are many things emitting ultra-weak light invisible to the human eye. "Bioluminescence" involves a biophoton phenomenon resulting from enzyme reactions. "Chemiluminescence" (chemical luminescence) is the phenomenon arising from chemical reactions. Compounds generated in an excited state by chemical reactions, released to the ground state, discharge light. Exposed to the atmosphere almost all materials generate chemiluminescence as a result of oxidation reactions.

The Chemiluminescence Analyzer (CLA series) is the most sensitive photon counting device and the only spectrometer with that sensitivity in the world. It detect down to 50 photons/cm²/sec (about 1/10000 of a firefly) or 10⁻¹⁵ Watts.



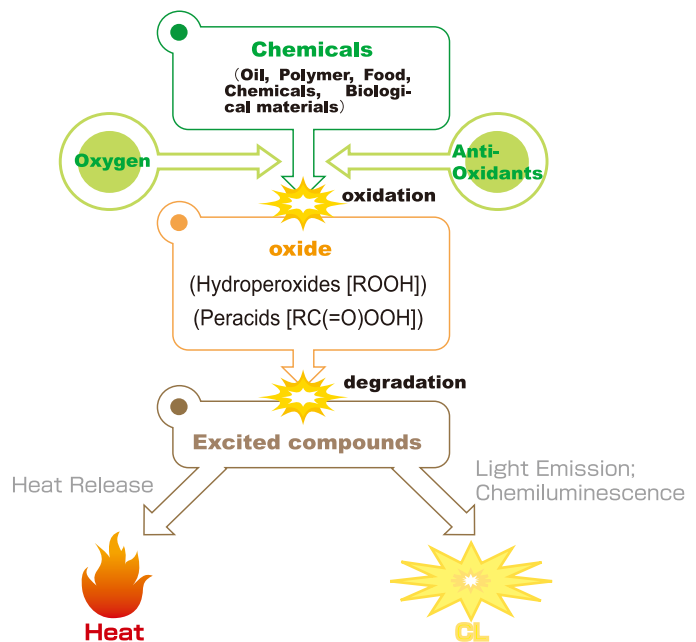
A+B : Reactive Material
E : Excited state
Ea : Active energy
ΔH : Active enthalpy
P* : Revitalization medium
P : Product
hv : Luminescence



Chemiluminescence with Oxidation

The products of luminescence according to the Russell Mechanism are singlet oxygen and excited carbonyl arising from the bimolecular degradation of hydroperoxides*. When an excited carbonyl species is released to the ground state, it gives out its energy as a photon of light. Therefore by following this chemiluminescence, it is possible to measure the degree of oxidation or degradation of a sample. This is a unique and extremely sensitive measure of oxidation.

*formed during oxidation



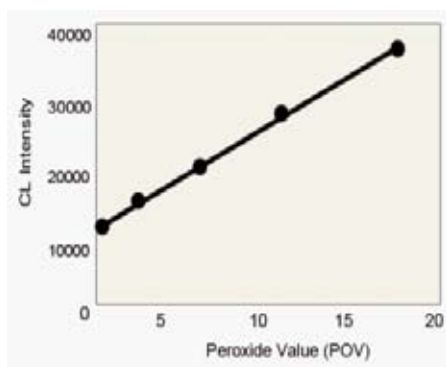
It is known that luminescence species are excited carbonyls (C=O*) or singlet oxygen (¹O₂) which produced during the oxidative reaction.

Application Fields

Fields	Sample	Purpose	Comment
Polymer	Polyolefin, Paint, Rubber, Resin, Adhesive, Packing etc.	Oxidation, Deterioration, Oxidative stability, Additive evaluation, (metal etc.) Anti-oxidation, Active oxygen, Radiation/ultra-violet	All organic materials including polymers emit light (chemiluminescence) on oxidation. We can use this phenomena as a really accurate measure of the extent of oxidation in a material. CL measurement of oxidation can be applied to bulk commodity polymers such as those used for utensils and packaging and also to high performance materials used in the aerospace and automobile industries.
Food	Cooking oil, Beer Food Stuffs, Processed Food Wine, Tea, Miso, Meat and Fish etc.,	Oxidation Deterioration Anti-oxidation Lipid peroxidation Active oxygen Radiation/ultra-violet rays damage	Chemiluminescence measurements of food oxidation monitor the levels of lipid peroxides and can be easily correlated to other standard tests. The technique can be applied to both processed and natural foods as well as individual components/ingredients. Therefore chemiluminescence analysis is a highly sensitive and easy to use quality control technique for the food industry.
Biochemistry	Blood,Urine, Internal Organs, Skin, Nerve, Muscle, Cells, Plants, Seeds, Medicines, Tablet, Chinese medicine, Egg, etc.	Aging,Oxidation, Deterioration, Anti-Oxidation, Lipid Peroxidation, Active oxygen, Radiation/ultra-violet	When biological damage occurs, this results in an accumulation of activated oxygen which can give rise to further damage in living tissue. Often this results in a build up to peroxides whose degradation gives rise to chemiluminescence. In this way tissue damage can be easily monitored using our chemiluminescence techniques.

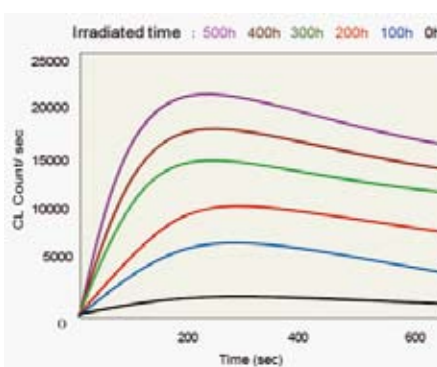
Measurement Data

Correlation between POV and CL



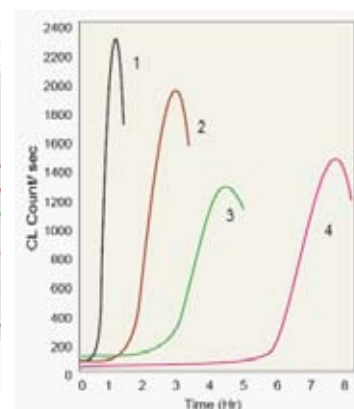
Sample	Food Oil
Meas.Temp.	60 degree
Gas	Air

CL of irradiated Polypropylene



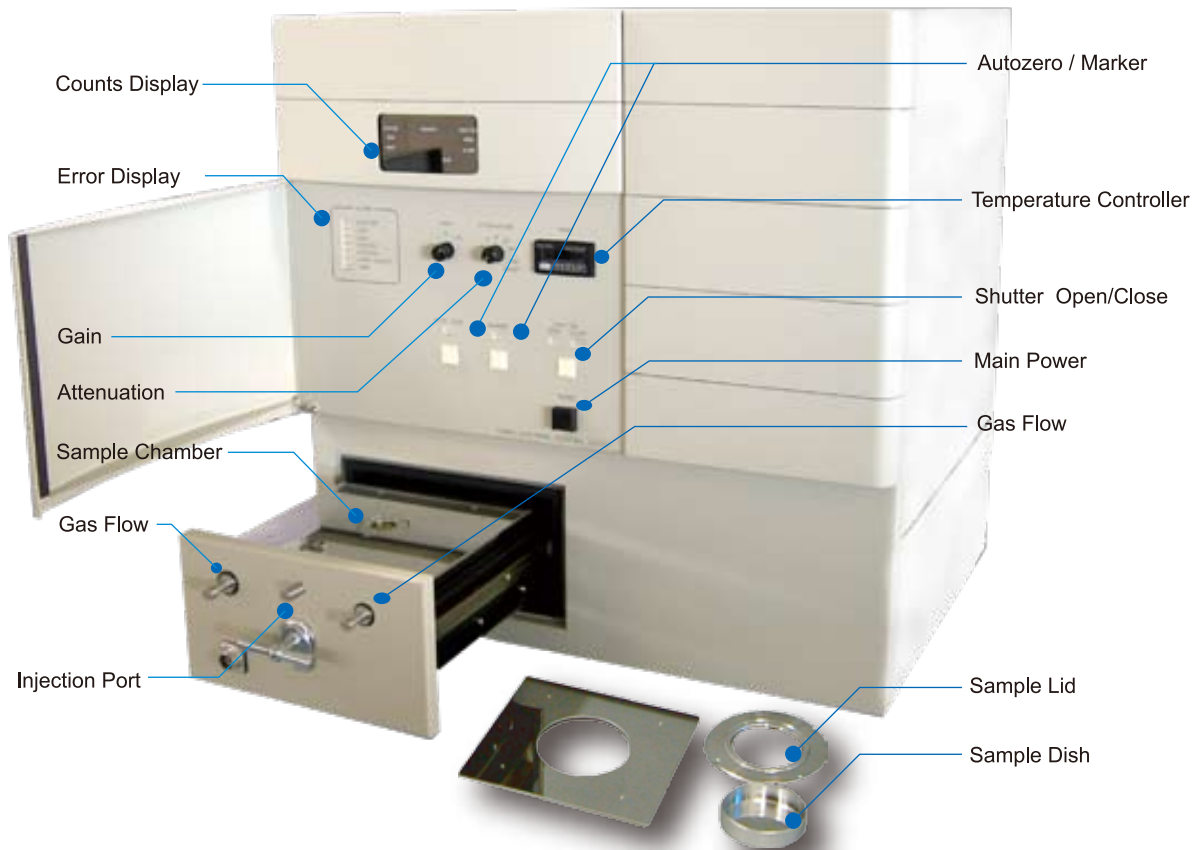
Sample	Polypropylene Irradiated by Xenon from 0 to 500 hr
Meas.Temp.	100 degree
Gas	Air

Oxidation Induction Time



Sample	Base : Polyethylene Antioxidants: 1 None 2 IonoX220 3 EtanoX330 4 Irganox1010
Meas.Temp.	100 degree

CL Analyzer – Configuration View



CL Analyzer – Schematic View

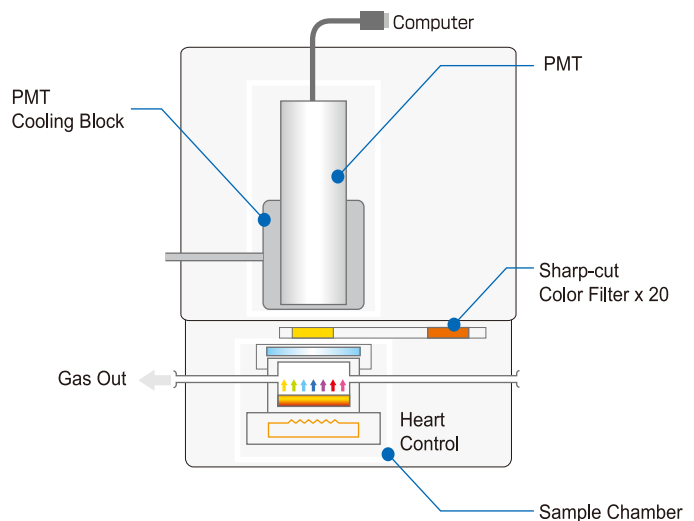
High sensitivity luminescence detection device

The detector consists of a Photomultiplier (PMT), sample chamber, temperature controller, spectrometer and a data analysis system.

The PMT is cooled by an electric cooling device to decrease the noise and to realize high sensitivity.

The 50mm diameter sample dish can be used to measure either solid, liquid, gas, and fine particles without adjustment.

It is possible to make a special sample chamber, large, small, etc.

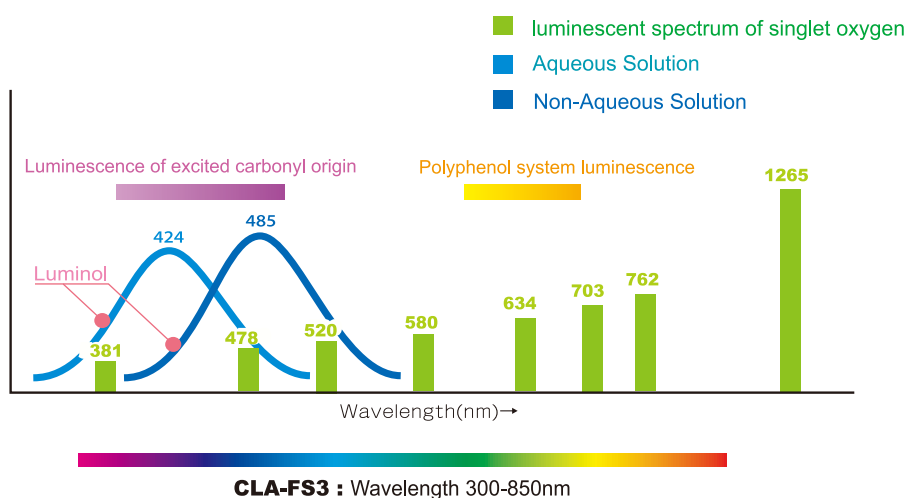


Spectrum Measurement

The only spectrometer in the world for ultra weak luminescence

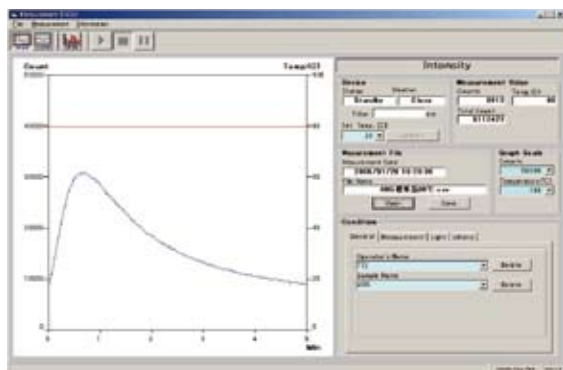
The total luminescence from a sample arises from a variety of sources. Therefore it is important to know the wavelength of photon emitted from a sample. This can help to identify the source. The 20 optical filters mounted inside this accurate instrument allow it to measure the spectra of ultra weak luminescence. This is the only spectrometer in the world capable of delivering such sensitivity.

① Luminescence spectrum of Luminol



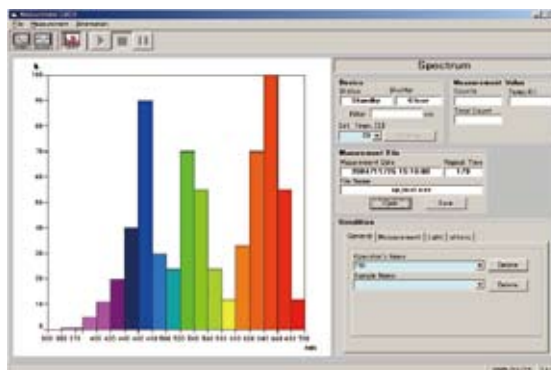
Measurement Mode

CL Intensity measurement






It is possible to measure the total wavelength luminescence from the sample per one second to investigate early oxidation or deterioration by observing the peak, rate, and area of the luminescence curve. The maximum measurement time is 10 days. The optical filter can be set to measure the specific wavelength from the sample.

CL Spectrum measurement







Spectrum measurements of luminescence can be made by automatically moving the 20 optical (High Pass) filters incorporated in the instrument.

Specifications

Product name Model	Chemiluminescence Analyzer Model:CLA-FL2	Chemiluminescence Analyzer Model : CLA-ID3	Chemiluminescence Spectrometer Model : CLA-FS3
Product	 Detector+Flow type Sample Chamber	 Detector+Sample Chamber+DASH M1/A1	 Detector+Sample Chamber+DASH M1/A1
Counting	Single photon counting with photomultiplier tube (PMT)		
Detection Wavelength	300nm - 650nm (max.quantum efficiency: 430nm)		300 nm~850 nm (Center wavelength: 420 nm)
Software	None	DASH M1/A1	
Cut Filter	None		330 nm~700 nm (20 filters with an interval of 20 nm)
Filter Exchange Device	None		Rotating table with 20 filters controlled by computer.
Cooling	Primary cooling : Peltier Electronic Cooling Secondary cooling : Water Chiller		
Temperature Control	Electronic Heater embedded in sample chamber Temperature controller is on the front panel.	Electronic Heater embedded in sample chamber temperature controller is on the front panel (Temp.control can be done manually or computer)	
Sample Chamber used	CLS-FL / 50C or less	CLS-FL / 50C or less CLS-MX3 / 100C or less CLS-LA3 / 100C or less	CLS-FL / 50C or less CLS-MX3 / 100C or less CLS-ST3 / 160C or less CLS-LA3 / 100C or less
Output Signal	Recorder Output: 1.0 V/F.S Integrator Output: 1.0 V/F.S		
Interface	None	RS-232 Interface (com1)	RS-232 Interface (com1, com2)
Power Source Size & Weight	AC 100V, 50/60Hz, 5A 310(W) x 420(D) x 524(H) mm, Approx. 35 kg		AC 100V, 50/60Hz, 5A 520(W) x 420(D) x 547(H) mm, Approx. 50 kg

Sample Chamber

Product Model	Flow type Model CLS-FL	Mixing type Model CLS-MX3	Heating type Model CLS-ST3	Laser type Model CLS-LA3
Sample Dish	Spiral Flow Tubing, Material: Teflon	A stainless steel sample dish is put in this holder	A stainless steel sample dish is put in this holder	Plate type (φ50mm)
Injection Port	2 ports on the front panel	1 port on the front panel (a TEIC needle is necessary)	1 port on the front panel (a TEIC needle is necessary)	None
Electrical Heater	Fixed under the holder Maximum temperature is 50C	Fixed under the holder Maximum temperature is 100C	Fixed under the holder Maximum temperature is 160C	Fixed under the holder Maximum temperature is 100C
Functions	Sample Chamber and an outlet is fixed on the front panel	IN (inlet) & OUT (outlet) on the front panel Magnetic sheet is built-in under the sample dish holder	IN (inlet) & OUT (outlet) on the front panel	LD Laser (375nm or 405nm) IN (Inlet) & OUT (outlet) on the front panel
Size Weights	 221(W) x 357(D) x 121(H) mm approx 2kg	 221(W) x 357(D) x 121(H) mm approx 4kg	 221(W) x 357(D) x 121(H) mm approx 4kg	 221(W) x 357(D) x 121(H) mm approx 4kg

CCD Camera Imaging Instrument

Imaging Detector CLA-IMG3



CCD camera enables an oxidation map image of the sample to be seen

CL Image of old(10years)wire cable

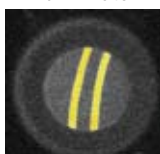
Real image



5min later



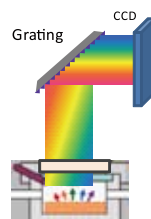
10min later



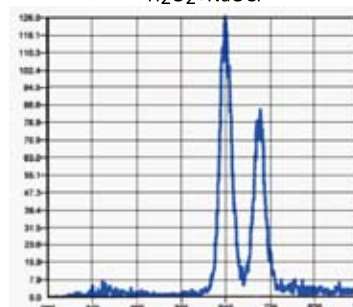
Quick Spectrometer CLA-SP3



Combining the high resolution grating unit with the CCD camera, produces a high resolution spectrum within one sec.



Spectrum of Singlet Oxygen
 $\text{H}_2\text{O}_2 + \text{NaOCl}$



Custom Order System

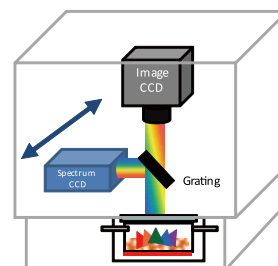
We can make various special sample chambers to your request.

PMT + Special Large sample chamber



For Tohoku University

Image + Quick Spectrum Measurement



CCD + Special Large sample chamber



For Tohoku University

Special designed (IR)PMT type



It is possible to detect 1270nm luminescence from the Singlet Oxygen



<http://www.tei-c.com>

Tohoku Electronic Industrial Co.,Ltd.

Chemiluminescence Analyzer is the trademark of Tohoku Electronic Industrial Co., Ltd.

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