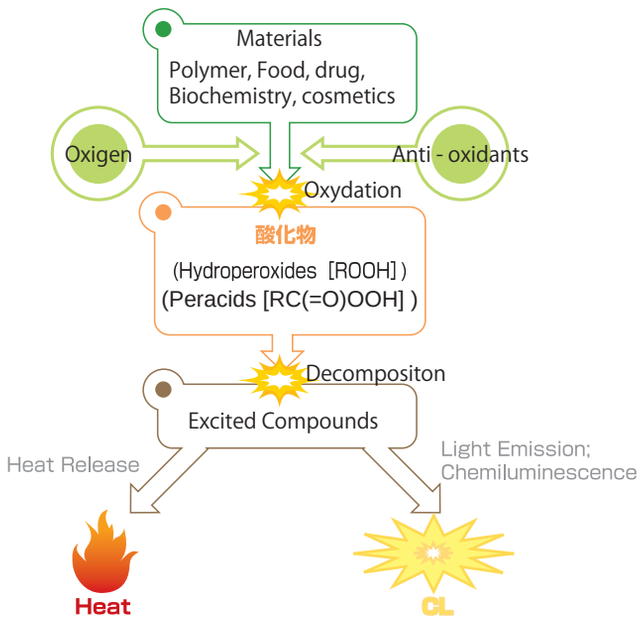
High-Performance Chemiluminescence Analyzer Series

Tohoku Electronic Industrial Co.,Ltd.

Chemiluminescence with Oxidation

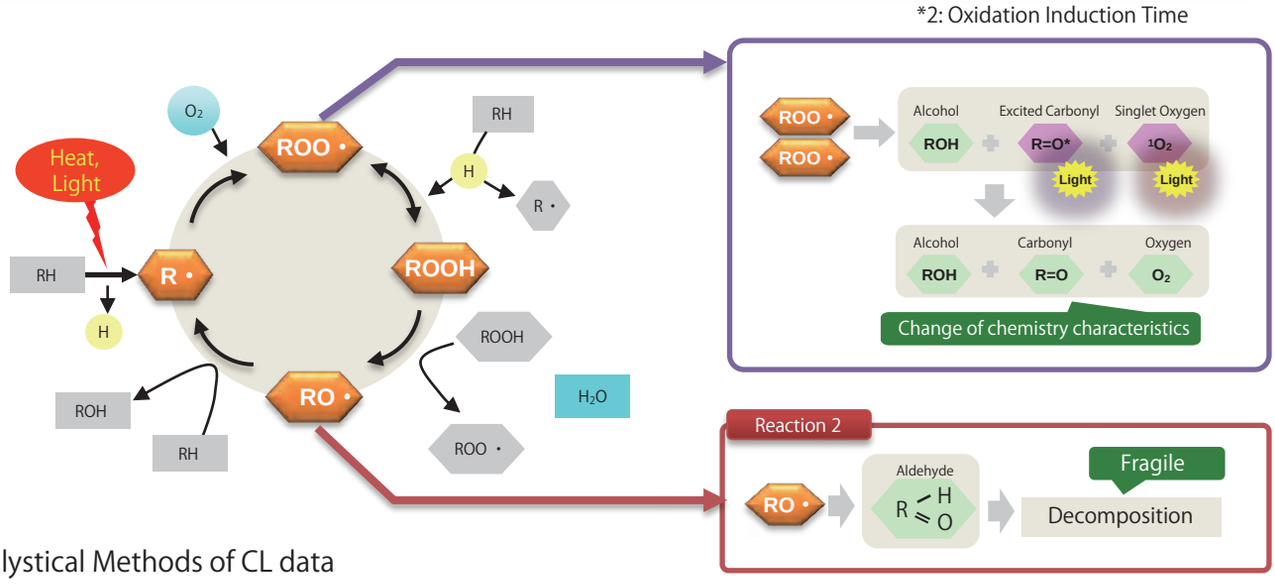
The products of luminescence according to the Russell Mechanism are singlet oxygen and excited carbonyl arising from the bimolecular degradation of hydroperoxides*1.
When an excited carbonyl species returns to the ground stage, energy is released as a photon of light. Therefore by following this chemiluminescence, it is possible to measure the degree of oxidation or degradation of a sample. This is a unique and extremely sensitive measure of the degree of oxidation.

*1: formed during oxidation

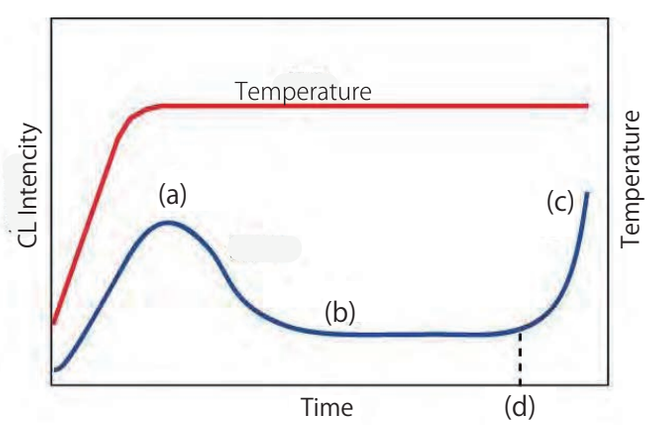


Auto Oxidation Mechanism and OIT*2

*2: Oxidation Induction Time



Analytical Methods of CL data



When we put samples into the sample chamber and heat them, the surcace oxidized products such as peroxides will be decomposed and will produce light first. After that, the anti - oxidants will inhibit the oxidation and keep CL lower. But after consuming the anti - oxidants perfectly, the auto - oxidation mechanism will start. As you know, this point is called oxidation induction time (OIT). The strong point of this measurement is that it is easy and fast to estimate the oxidation stability of new samples. And also we don' t need to oxidize before measurement.

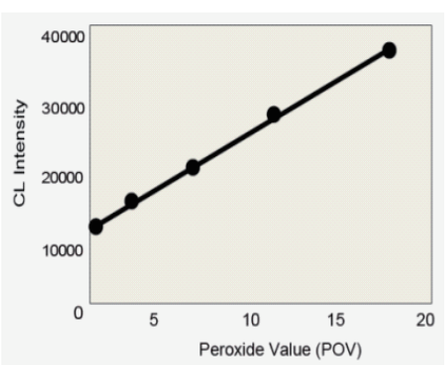
(a) is related to the surface oxidative products
(b) Effect of anti - oxidants to keep CL lower
(c) Polymer auto - oxidation starts
(d) Oxidation Induction Time (OIT)

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.

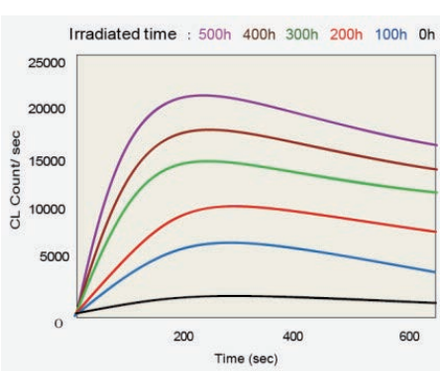
Measurement Data

Correlation between POV and CL



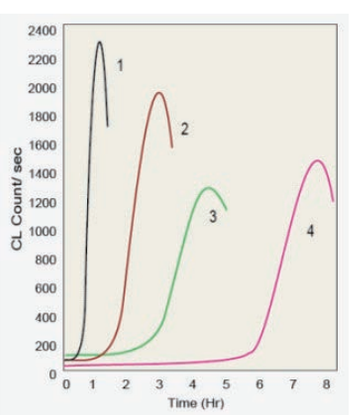
Sample	Food Oil
Meas.Temp.	60 degree
Gas	Air

CL of irradiated Polypropylene



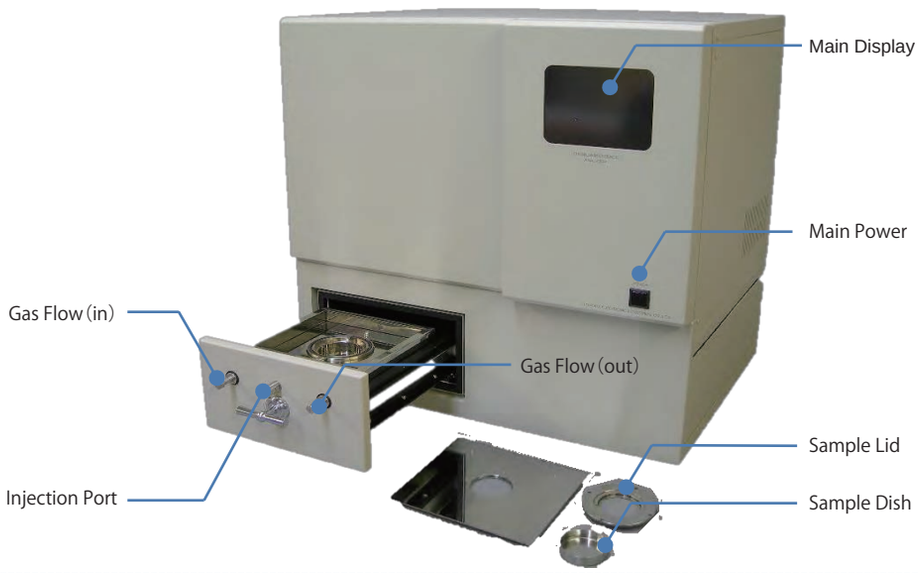
Sample	Polypropylene Irradiated by Xenon from 0 to 500 hr
Meas.Temp.	100 degree
Gas	Air

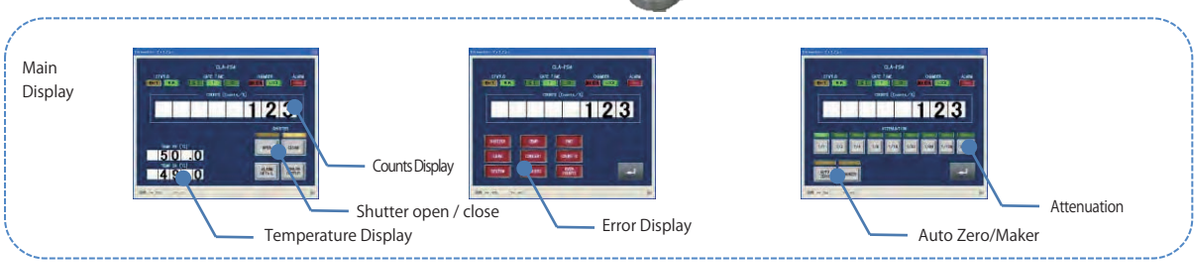
Oxidation Induction Time



Sample	Base : Polyethylene Antioxidants: 1 None 2 Ionox220 3 Etanox330 4 Irganox1010
Meas.Temp.	100 degree

CL Analyzer – Configuration View

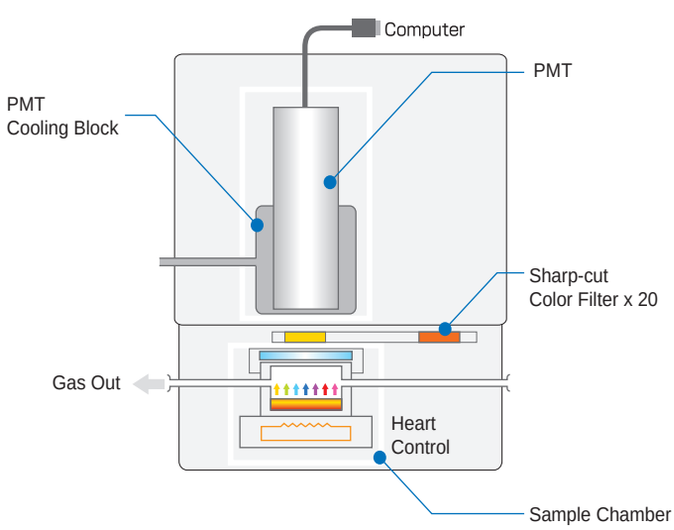




CL Analyzer – Schematic View

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.

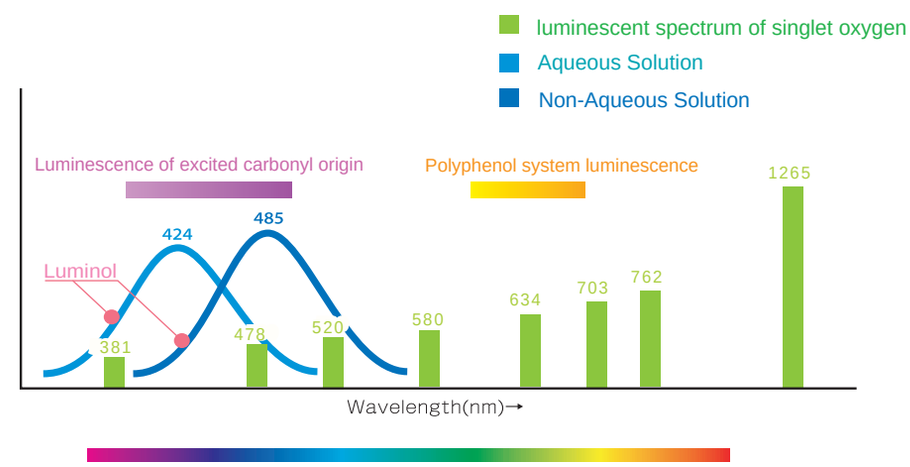


Spectrum Measurement

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.

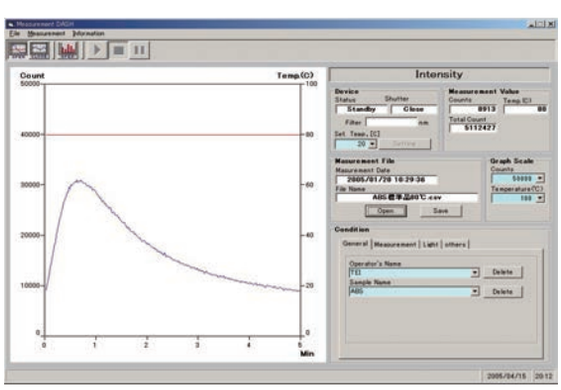
Luminescence spectrum of Luminol



CLA-FS3 : Wavelength 300-850nm

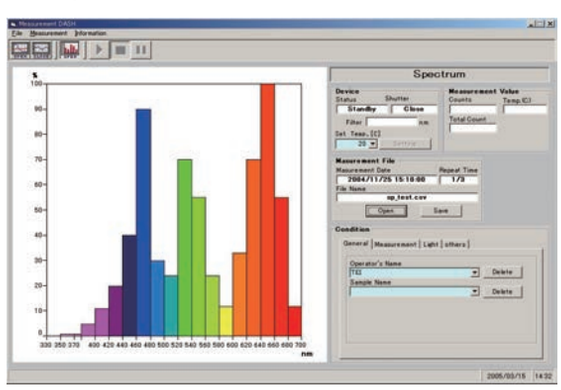
Measurement Mode

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

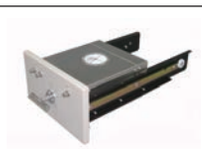
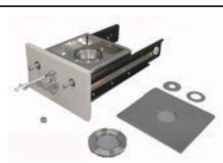


Spectrum measurements of luminescence can be made by automatically moving the 20 optical (High Pass) filters incorporated in the instrument.

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 temperrature 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

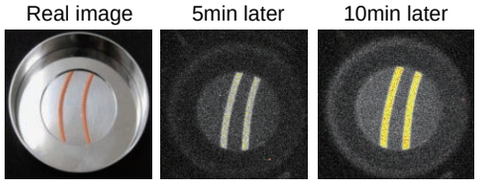
CCD camera enables an oxidation map image of the sample to be seen

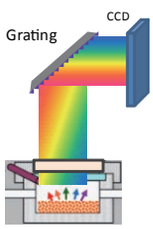
Quick Spectrometer CLA-SP3

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

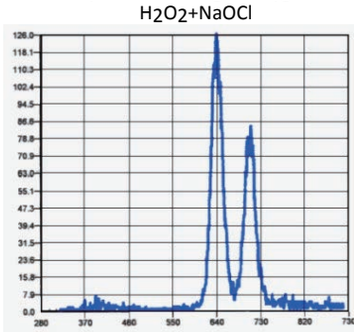
CL Image of old(10years)wire cable

Real image 5min later 10min later





Spectrum of Singlet Oxygen
H_2O_2+NaOCl



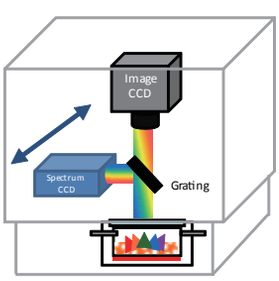
Custom Order System

We can make various special sample chambers to your request.

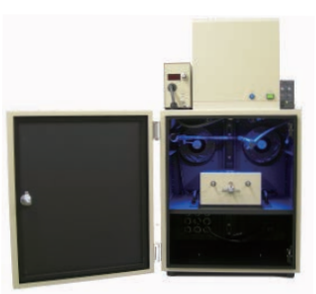
PMT + Special Large sample chamber

For Tohoku University

Image + Quick Spectrum Measurement



CCD + Special Large sample chamber



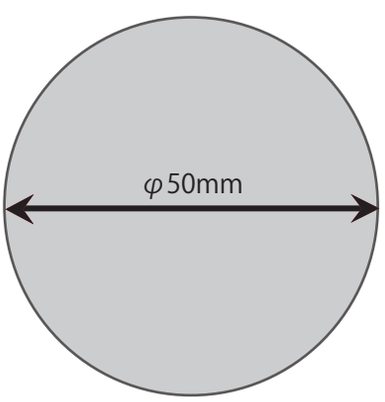
For Tohoku University

Special designed (IR)PMT type

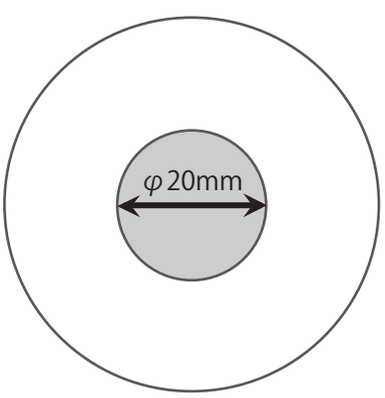
It is possible to detect 1270nm luminescence from the Singlet Oxygen

http://www.tei-c.com

standard cell in full-size



small cell in full-size



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Oct.2010 Vol.03_has08e