

To whom it may concern Apr.24.2018

Light Scattering Method Dust Density Meter

(Relative continuous measuring monitor system)

Model ***DDM-fC***

Technical Introduction

R&D , Manufacture , Sales , Maintenance

Tanaka Electric Laboratory Co., Ltd.

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Corporate profile

Established 17.Dec. in 1963
Capital 25,000,000 JPY
Employee 35



Business Scope :

- 1. Dust density meter R&D, manufacture**
- 2. Electronics instruments design & manufacture for industry use**
- 3.PCB design , mounting & soldering.**



About CEMS (Continuous Emission Monitoring System)

- CEMS is an equipment used to measure emissions discharged from stationary sources.
- CEMS helps in the continuous assessment of pollutants discharged into the atmosphere in the form of exhaust gases from combustion or industrial processes.
- Initially, CEMS was used to monitor oxygen, carbon dioxide, carbon monoxide.
- Currently, CEMS **including dust** is used to adhere to air emission standards.

CEMS Instruments



HCl Gas analyzer



NO_x, SO₂, CO, CO₂, O₂ Gas analyzer



Dust density meter DDM-fC

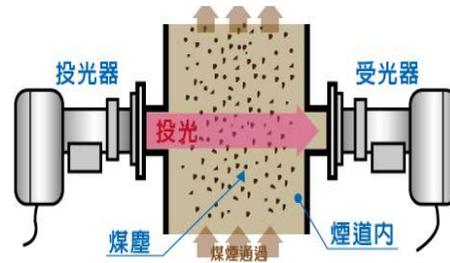
A lot of dust from chimney !



The emitted dust exceeded the applicable limit concentrations, the residents in adjacent plants will complain to the relevant authorities.

Type of dust density meter

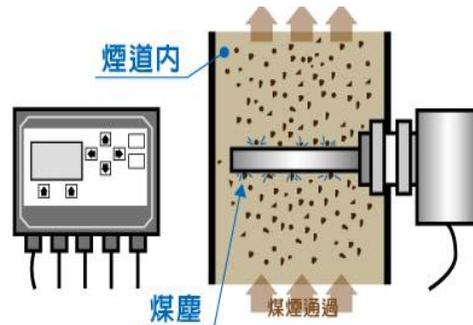
① Optical penetration type



Advantage: **Cheap**

Disadvantage : The detection sensitivity is low, and optical axis shifts.

② Electrode type

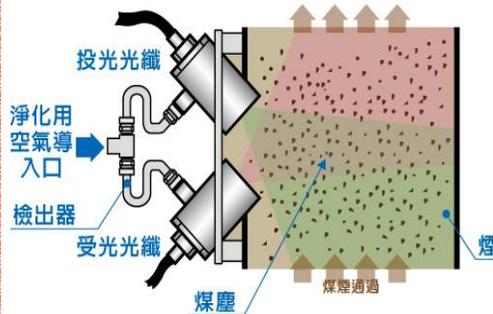


Advantage : **Easy installation.**

Disadvantage : The moisture influences to the output signal. This type cannot be span-calibration under plant operation.

Our system !

③ Light scattering type



Advantage: **Low concentration can be measured.**

The correlation coefficient is high.

Disadvantage: Multiplex scattering appears over about 500mg/Nm³ .

Note: The typical dust limits for industries in Malaysia is 50mg/Nm³. → Light scattering type is suitable !

About our model DDM-fC (Main body control box and purge air system box)



Purge air system box

Main body control box

- 1) Our DDM-fC is **non-sampling** method dust density meter.
- 2) It is easy to be installed and maintained.
- 3) There is **no optical shifts and influence from moisture**,
- 4) It is possible to zero-calibrate the system and adjust the measurement span under different plant operating conditions, such as high pressure (up to 246kPa) or high temperature (typically 380°C, optional up to 820°C) .
- 5) Our design concept is easy maintenance for a long time in plants. **Selected general purpose parts as consumer matter** such as halogen lamp & motor.

Easy installation

Installation on the duct is only **one place**, the **optical axis match is unnecessary**. The air piping also. By using existing handrail, it is very **easy to install**. The **construction cost will be half** compared to the optical penetration type.



Calibration (It is possible to adjust zero & span under plant operating.)



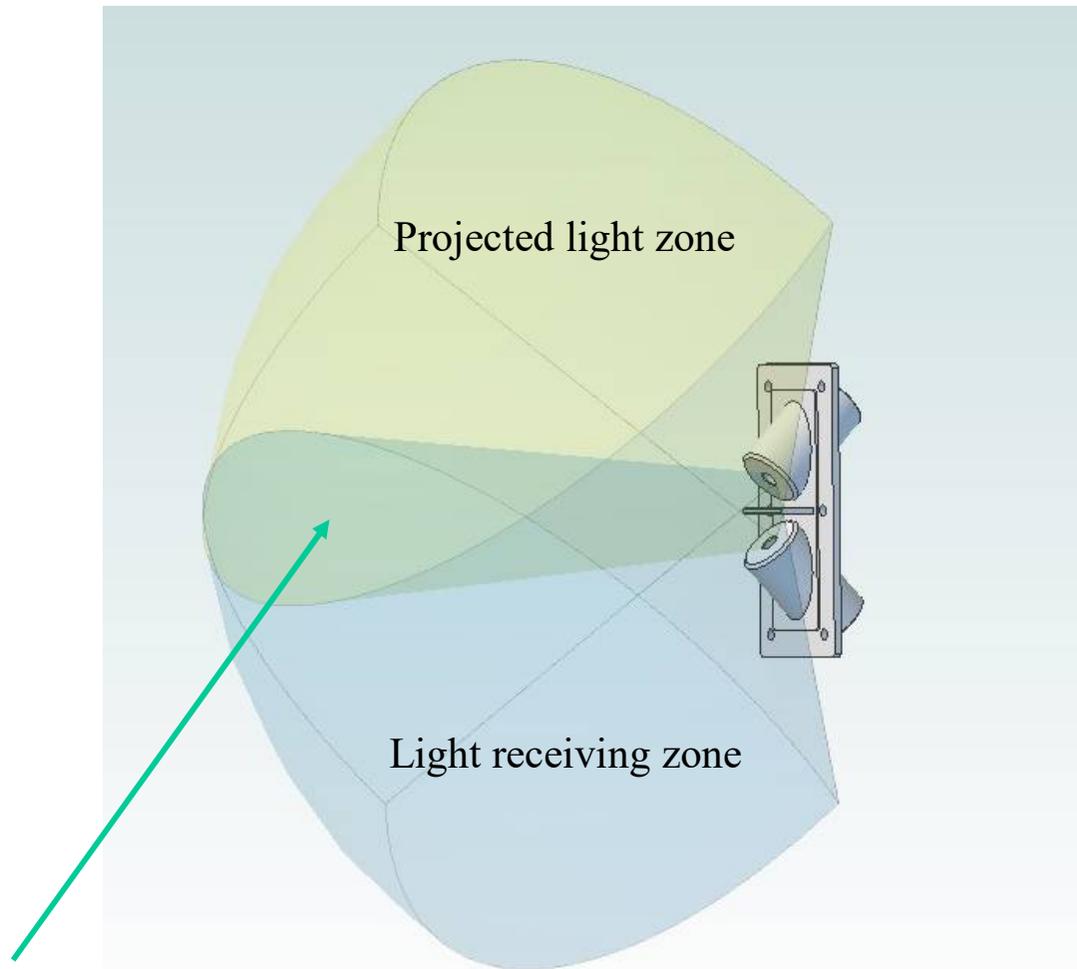
It is possible to connect to the calibration box by removing optical fiber cables from detector head even if flue gas flows.



**Under high pressure 246kPa、20%CO gas
Calibration by safety. (Blast furnace plant)**

Three-dimensional measurement range image of back scattering type dust density meter detector (DDM-fc)

Our DDM-fc uses a halogen lamp with overwhelmingly large amount of light as a light source.



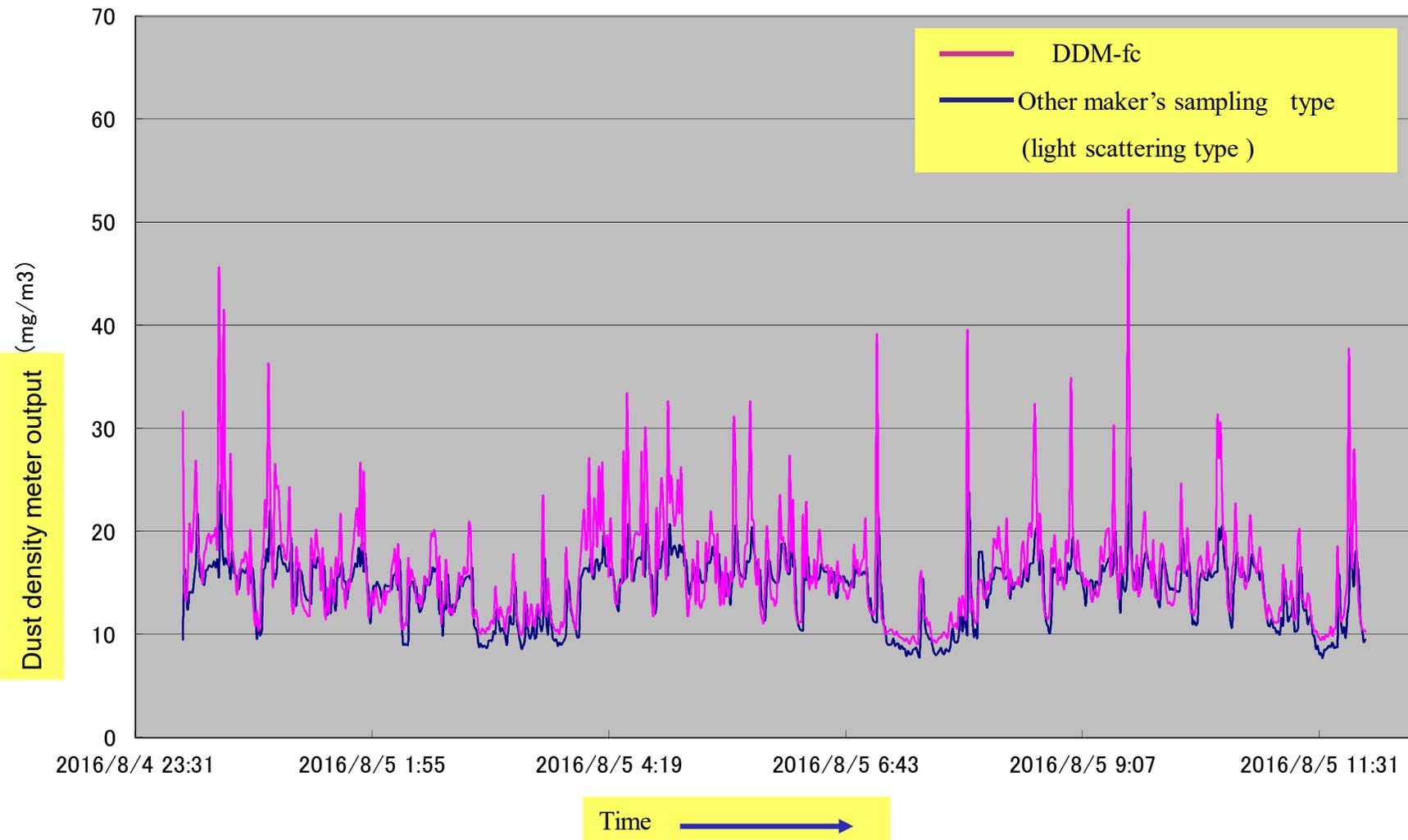
Note :This figure shows DDM-2001

- Measuring zone is the area where the projected light and crossing with the light receiving.
- This is very high volume zone.
- This means, our DDM-fc is very high sensitivity instrument.

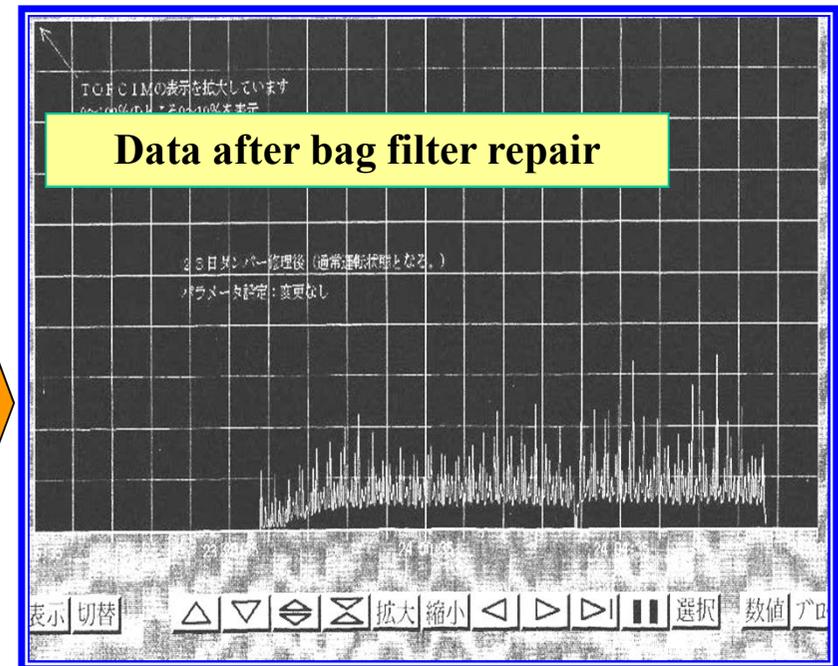
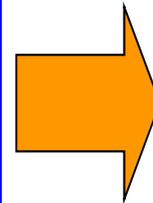
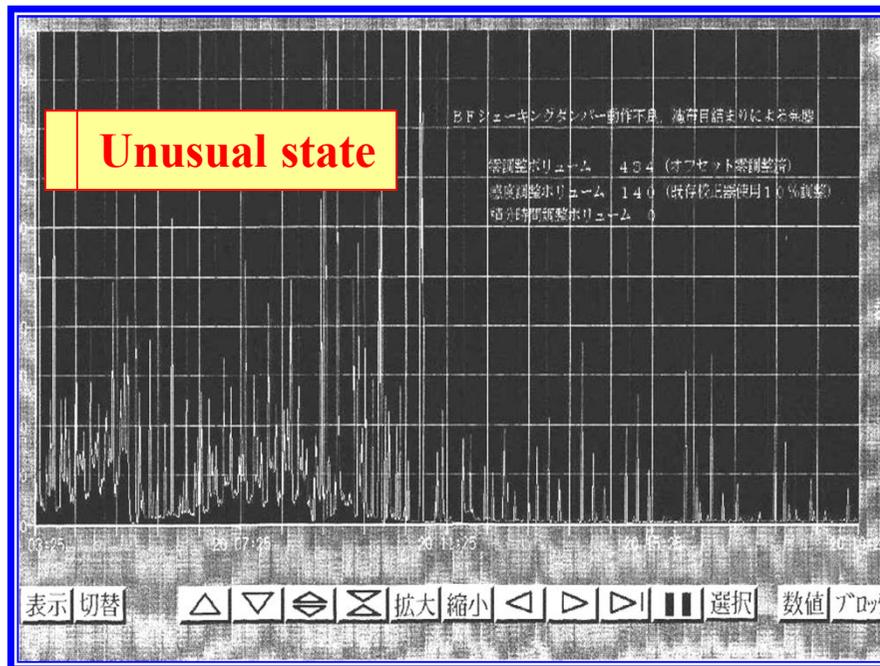
Light scattering method : comparison between sampling method and non-sampling our DDM-fc.

... The sampling type only measures the nozzle inlet for aspirating dust particles, so there is little change in output signals. Meanwhile, our company's non-sampling type has a wide measuring range, so the indication change can be seen largely.

Coal fired electric power station. Inlet of FGD.



Measurement data (tendency management)



The continuous dust monitor is an important tool to schedule preventive maintenance.

As a result of performing preventive maintenance on the dust collector systems (EP and FF)*, undesirable discharge of high loadings of dust to the atmosphere can be effectively prevented.

*** EP: Electrostatic Precipitators FF: Fabric Filter same as Bag Filter**

Recent News!

- JIS B7996 will be effective in 2018

[Performance evaluation test method of automated concentration monitoring instrument of dust in flue gas.]

Tanaka Electric Lab. offered to make a Japan Industries Standard (JIS) about dust density meter's evaluation method to METI in 2016.

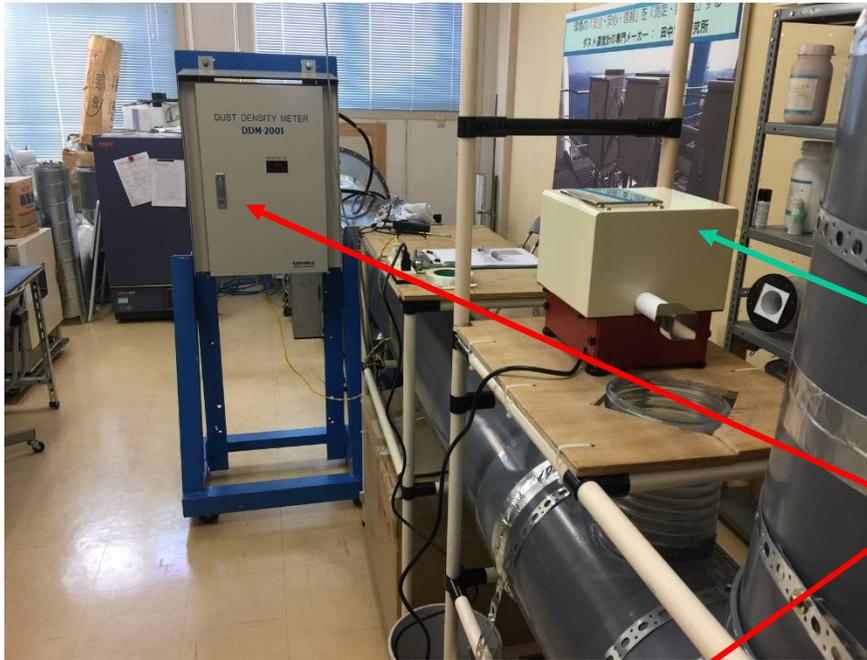
(METI: Ministry of Economy, Trade and Industry in Japan)

- This is the first standard of dust density meter's performance for type approval test.
- The most important point is a correlation coefficient between isokinetic sampling method and automated dust monitor. This must be over 0.9 by actual method by using test duct at laboratory.

Test duct at Tanaka electric lab. in Karasuyama factory.



Duct : Straight length is 4,225mm , diameter is 300φ

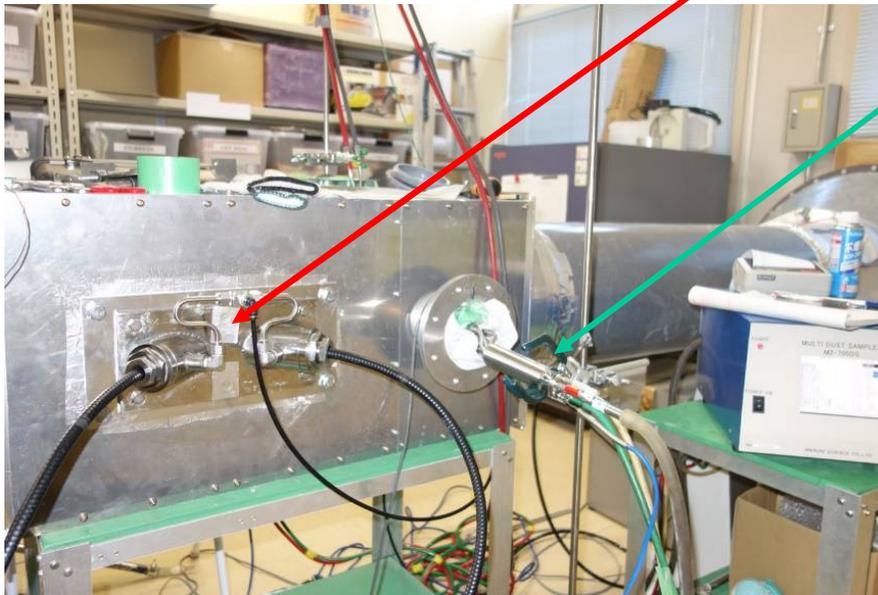


Test for getting correlation coefficient between isokinetic sampling method and automated dust monitor.

Dust feeder

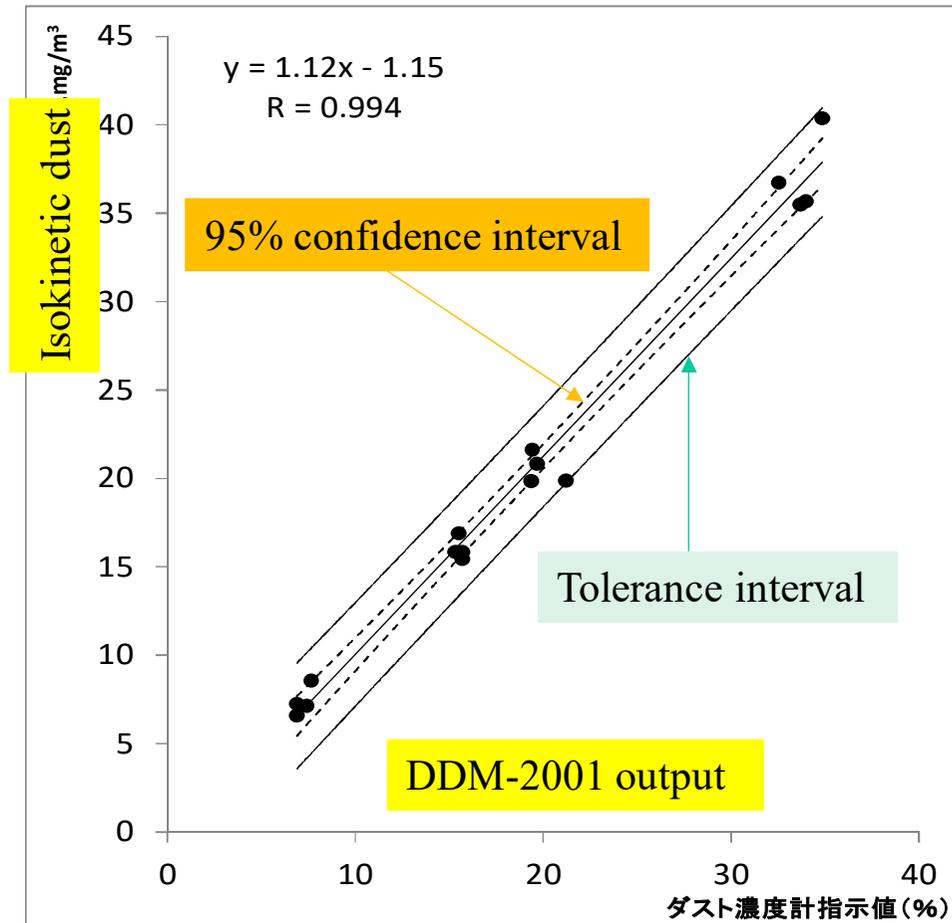
Our dust monitor DDM-2001 (same as DDM-fC)

Isokinetic sampling method probe



Other maker's electrode type dust monitor

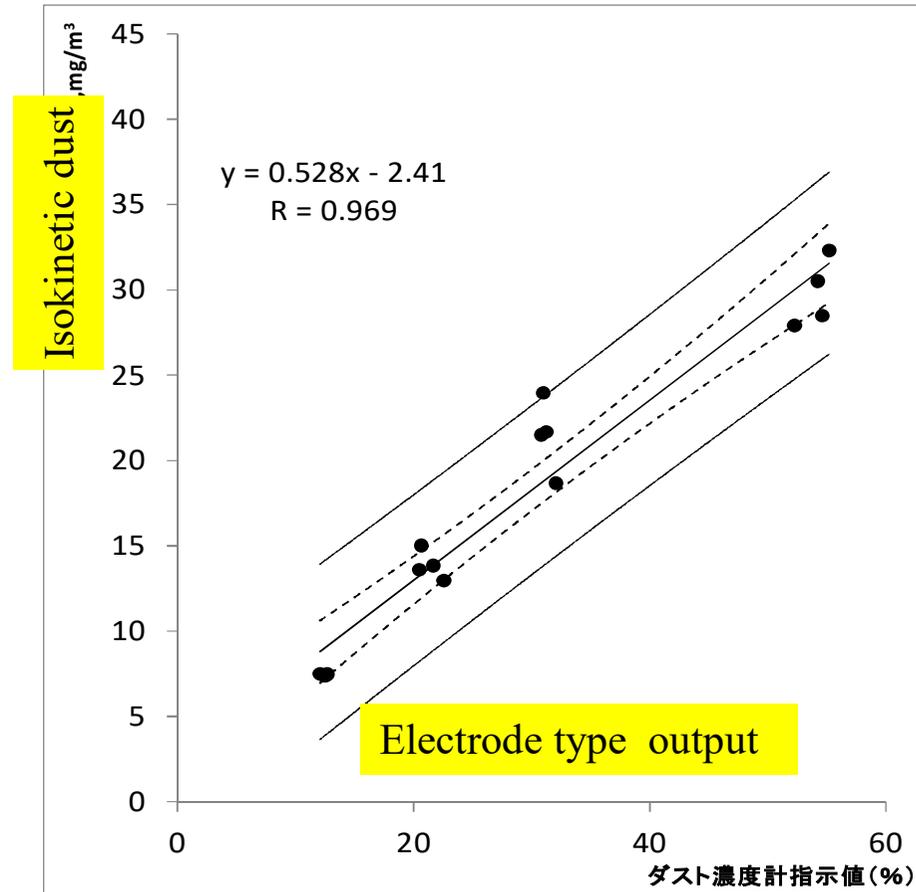
試験用粉体	ダスト濃度 (JIS Z 8808)	ダスト濃度計 (DDM-2001)	相関係数
	mg/m ³	指示値(%)	
フライアッシュ 10種	8.6	7.668	0.994
	7.2	7.432	
	7.3	6.899	
	6.6	6.889	
	16	15.698	
	15	15.689	
	16	15.330	
	17	15.512	
	20	21.222	
	21	19.668	
	22	19.424	
	20	19.361	
	40	34.858	
	36	33.992	
36	33.691		
37	32.551		



Linear Calibration Curve

Correlation Coefficient between isokinetic sampling and DDM-2001.
Result is very high 0.994 and linear calibration curve is narrow.

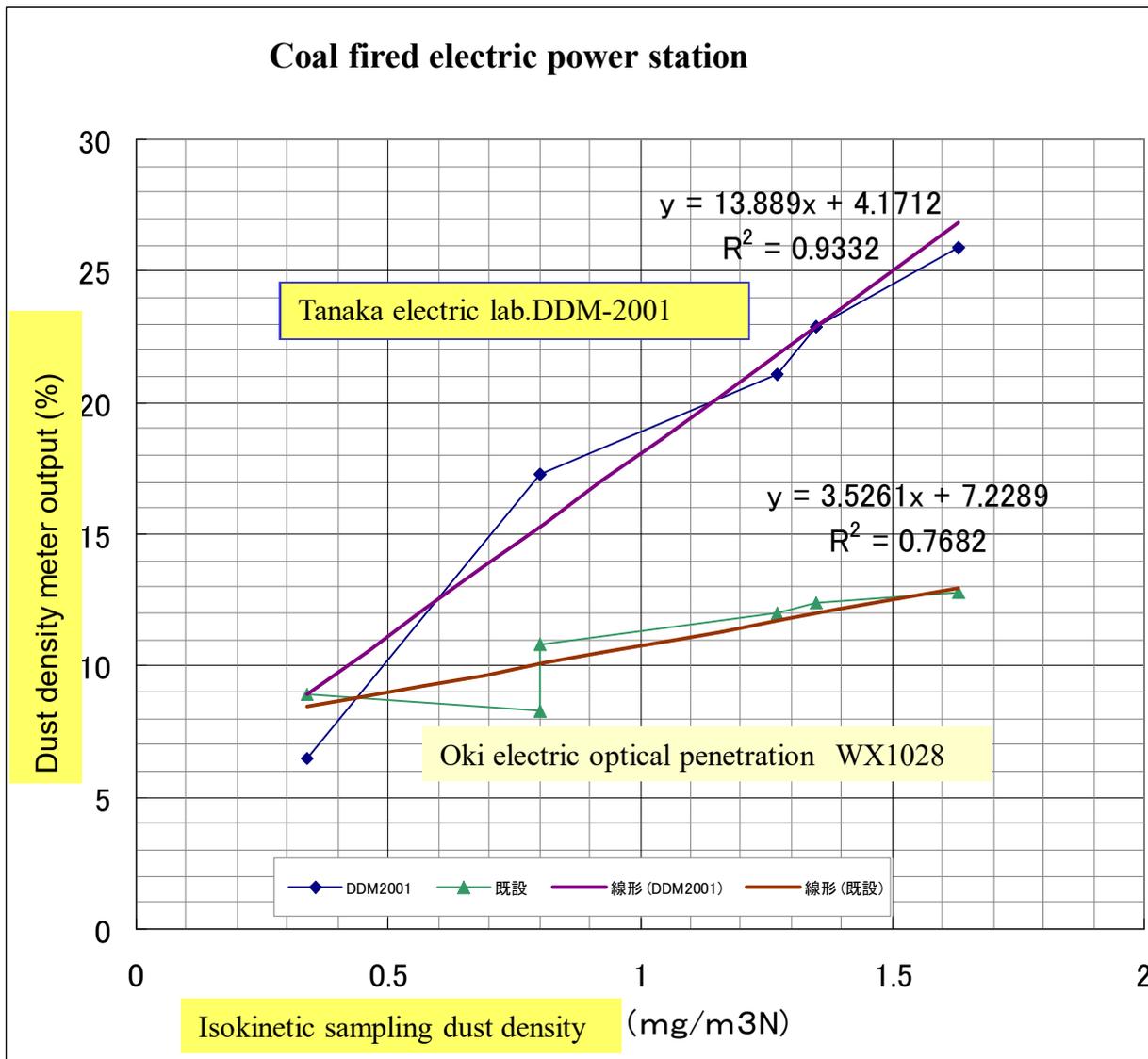
試験用粉体	ダスト濃度 (JIS Z 8808)	ダスト濃度計 (PFM-M01E)	相関係数
	mg/m ³	指示値(%)	
フライアッシュ 10種	7.5	12.665	0.969
	7.4	12.588	
	7.4	12.454	
	7.5	12.067	
	14	20.481	
	15	20.645	
	14	21.676	
	13	22.550	
	19	32.041	
	22	31.219	
	24	30.995	
	22	30.789	
	28	54.598	
	28	52.249	
32	55.193		
31	54.234		



Linear Calibration Curve

Correlation Coefficient between isokinetic sampling and electrode type.
Result is 0.969 and linear calibration curve is wide.

Correlation coefficient between isokinetic sampling (JISZ8808) DDM-2001 VS. Optical penetration

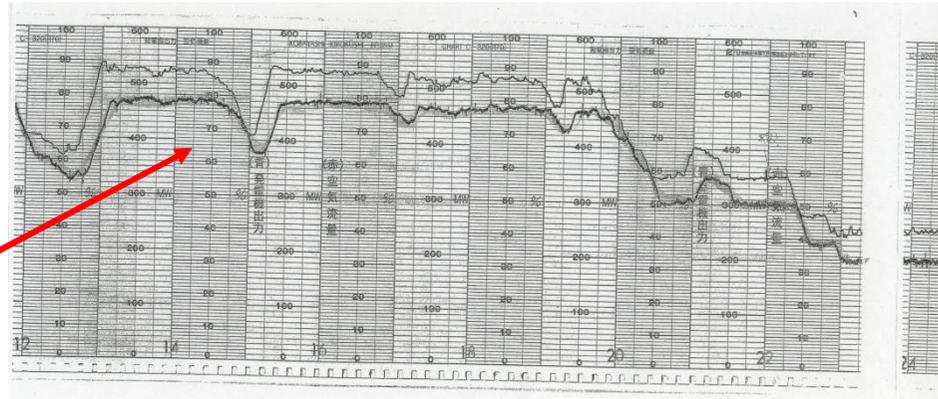


I.e. JISZ8808 in Japan or equivalent method Malaysian Stand, MS 1596 as required by law in only an ad-hoc analysis conducted several times per year

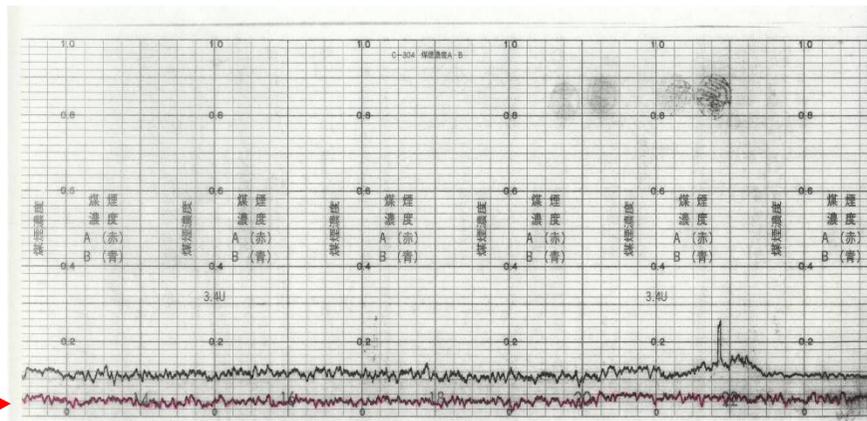
Note :model DDM-2001 is the same electronics circuit as DDM-fC

Comparison data with optical penetration dust density meter (Heavy oil electric power station.)

Generator output trend graph



**Dust density meter installed to the outlet duct of Desulfurization unit.
Dust density is under 1 mg / m³_N**



Other company's optical penetration type dust density meter output. (Synchronization with the operating condition is indefinite). trend data below.



DDM-2001 output trend data (Synchronized with the operation condition.)



Note :model DDM-2001 is the same electronics circuit as DDM-fC

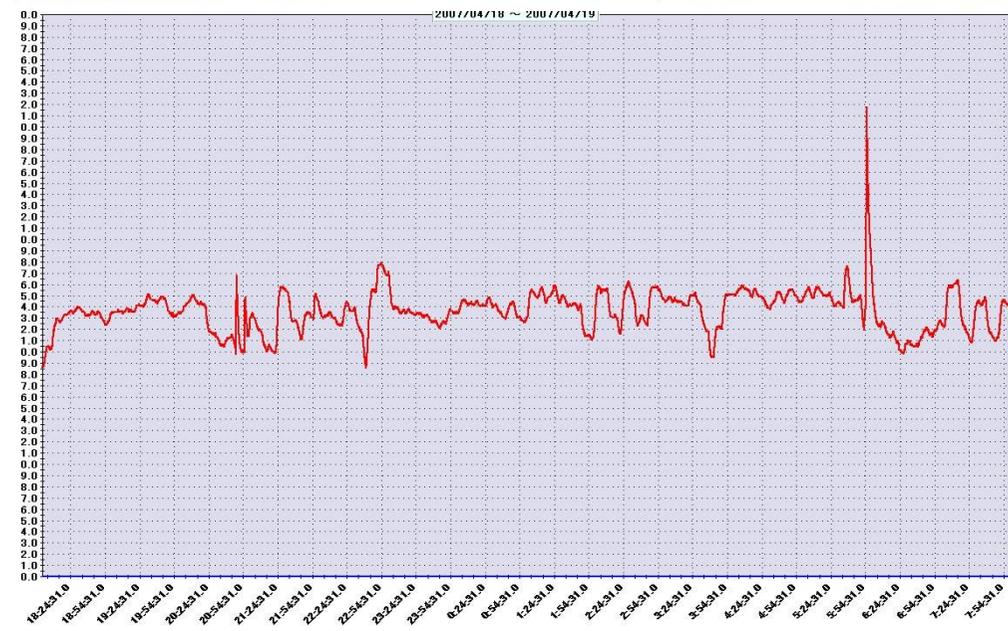
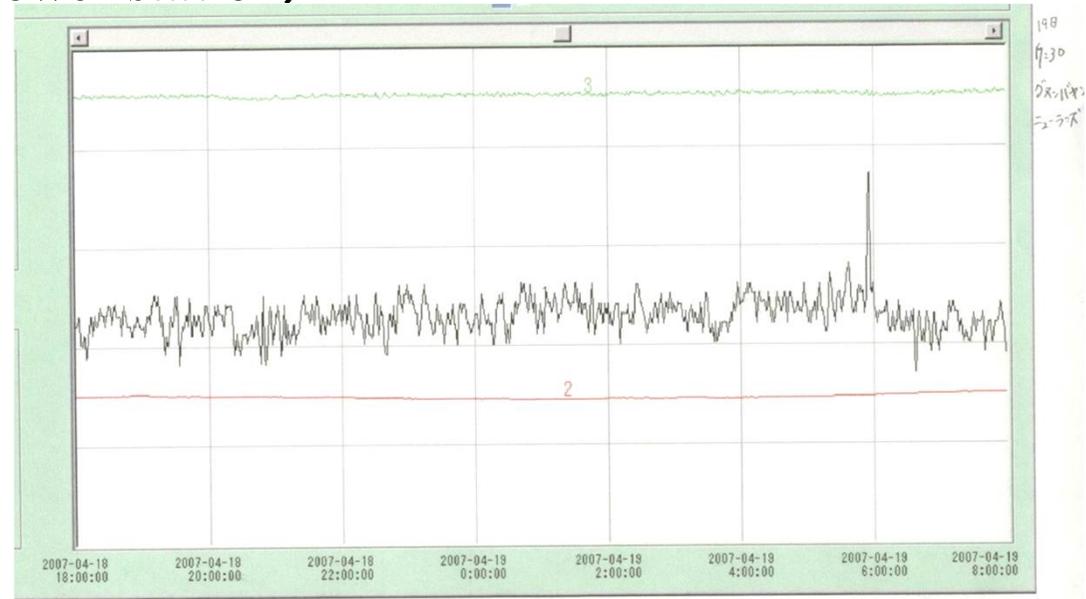
Comparison data with optical penetration dust density meter (Coal fired electric power station)

Duct size is 8m

Optical penetration type dust density meter output.

Measurement data near duct wall by DDM-2001. The same trend data as optical penetration type. The sensitivity is higher than the optical penetration type .

The same measurement was able to be done with the optical penetration type that measured the width of duct and light scattering type that measured near the wall of duct.



Note :model DDM-2001 is the same electronics circuit as DDM-fC

Installation photos.

Installation at Cement plant 1



AQC(Air Quenching Cooler) EP outlet stack

The measurement is possible without being affected by the sun light.



Detector head installed at duct open end.

* Note :This photo is DDM-2001 model

Installation at Cement plant 2

Mill bag filter outlet duct. Ryukyu Cement in Okinawa.



*** Note :This photo is DDM-2001 model**

Detector head attached near end of duct.

Installation at Cement plant 3

Mill bag filter outlet duct. Ryukyu Cement in Okinawa.



*** Note :This photo is DDM-2001 model**

Installation at Cement plant 4

CFB boiler bag filter outlet duct at Taiheiyo Cement Saeki plant in Kyusyu



CFB: Circulating Fluidized Bed boiler



Installation at Cement plant 5

Kiln cooler EP outlet duct at Mitsubishi material Iwate factory.



Installation at Electric power station 1



Coal electric power EP outlet



Heavy oil electric power EP outlet



* Note :This photo is DDM-2001 model

Installation at electric power station 2



J-POWER Isogo Coal fired electric power plant near Tokyo



Cyubu electric and Okinawa electric oil fired power plant

Installation at Iron furnace



Kobe steel Kakogawa plant



Installation at Refinery

Detector attached to the concrete duct via stainless steel plate.



Customer list 1

Mitsubishi material Corp. Yokoze
Mitsubishi material Corp. Kyusyu
Cyugoku electric power Co. Ube
Onoda cement Co. Tsukumi
Ube kosan Co. Kanda,Kyusyu
Sumitomo metal industries Co. Kashima
Aso cement Co. Kanda,Kyusyu
Ryukyu cement Co. Okinawa
Chichibu onoda cement Co. Chichibu
Mitsubishi material Corp. Kurosaki
Myojyo cement Co. Itoigawa
Dai showa peper making mfg.Co. Fuji
Taiheiyo cement Co. Chichibu
Asahi glass Co. Sagami
Nippon steel chemical Co. Kimitsu
Nissshin steel Co. Kure

Sludge incinerator Jyounanjima Tokyo
Sumitomo osaka cement Co. Kochi
Iwaki daio paper Co. Iwaki
Sumitomo osaka cement Co. Tochigi
Sumitomo metal industries Co. Kokura
Hachinohe cement Co. Hachinohe
Okinawa electric power Co. Kin
Oji paper Co. Kasugai
Nippon Seiko Co. Nakase
Chichibu taiheiyo cement Co. Chichibu
Mitsubishi material Corp. Kyusyu
Kyoei steel Co. Yamaguchi
Asahi glass Co. Keihin
Mitsui mining/Mitsui mike
manufacture Co. Omuta
Mitsubishi material Corp. Naojima

Industrial garbage incinerator Kagoshima

Nikko metal Co. Saganoseki

Birla cement works chittorgarh

Tokuyama Corp. (soda) Tokuyama

Bridgestone Corp. Hikone

Tokuyama Corp.(cement) Nanyo

Shinryo alumi recycle Co. Oyama

Taiheiyo cement Co. Saitama plant

J-power Co. Matsuura power plant

Kyoei steel Co. Nagoya

Eco energy Japan Co. Chiba

JFE steel Co. Chiba, Fukuyama

Oji paper Co. Kasugai/MHI Yokohama

Kobe steel Co. Kakogawa

DC Co. Kawasaki cement plant

Kansai thermo chemical Co, Kakogaw

Hokkaido electric power Co. Naie plant

Iwaki daio paper Co./ MHI Yokohama

Cyubu electric power Co, Atsumi plant

Kyusyu electric power Co. karita plant

Cyubu electric power Co, Chita plant

JFE Bars & Shapes Corp. Sendai

Taiheiyo cement Co. Tosa plant

Taiheiyo cement Co. Saiki plant

Nippon steel & Sumitomo metal Co.,Ltd.

Ube kosan Co. Ube IPP electric plant

Cyubu electric power Co,Nishi nagoya plant

Hokuriku electric power Co,Nanaooota plant

Nippon paper Co. Ishinomaki plant

Yoshino Gypsum Co. Saitama plant

Usha Martin Jamshedpur,India

EGAT Mae Moh coal electric fire power plant

Ulaanbaatar No.4 power station in Mongol

295 units in Apr.2018



Thank you for the attention!

tanaka
ELECTRIC LABORATORY