Public comments on the draft European PFAS regulation

(Use for clean room air conditioning and semiconductor equipment)

June 30, 2023

Cambridge Filter Corporation

Air filters for clean rooms and semiconductor equipment

Since the air taken in and circulated to semiconductor manufacturing equipment must be extremely clean, a HEPA/ULPA class filter is essential.

・ Impurities and foreign matter during semiconductor manufacturing may lead to defects, and if the collection efficiency is low, it will lead to a decrease in yield and poor characteristics.

・Electronics and pharmaceutical manufacturing require a clean environment, and a clean room with a high-performance air filter of HEPA or better is essential.

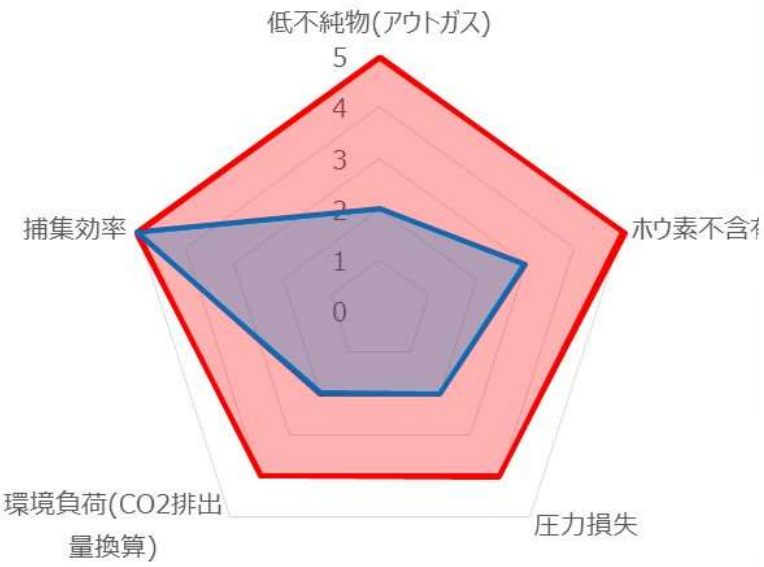
・If the PTFE membrane filter media is replaced with glass fiber filter media, the filter pressure loss (resistance) will be approximately doubled in order to ensure the collection performance. It is estimated that the energy required to circulate the same amount of air will be approximately doubled, increasing the impact on the environment. (P5, P6)

・If the collection efficiency of the air filter cannot be maintained at a high level, the products manufactured in the clean room will be contaminated, leading to loss of product functions and a decrease in yield.
It is required to suppress the decrease in collection efficiency during long-term use. When electret non-woven filter media is used as a substitute, HEPA or higher collection efficiency cannot be maintained from the beginning to the end of use, making it difficult to apply to clean room applications. (P7)

・When glass fiber (glass fiber) filter paper is used instead of PTFE membrane filter paper, the amount of outgas emitted from the components is increased by 10 times or more.
In addition, since impurities such as boron that are harmful to the manufacturing of various products are detected, the risk of defects in manufactured products due to contamination from filters increases. (P8, P9)

Characteristics comparison (overall)

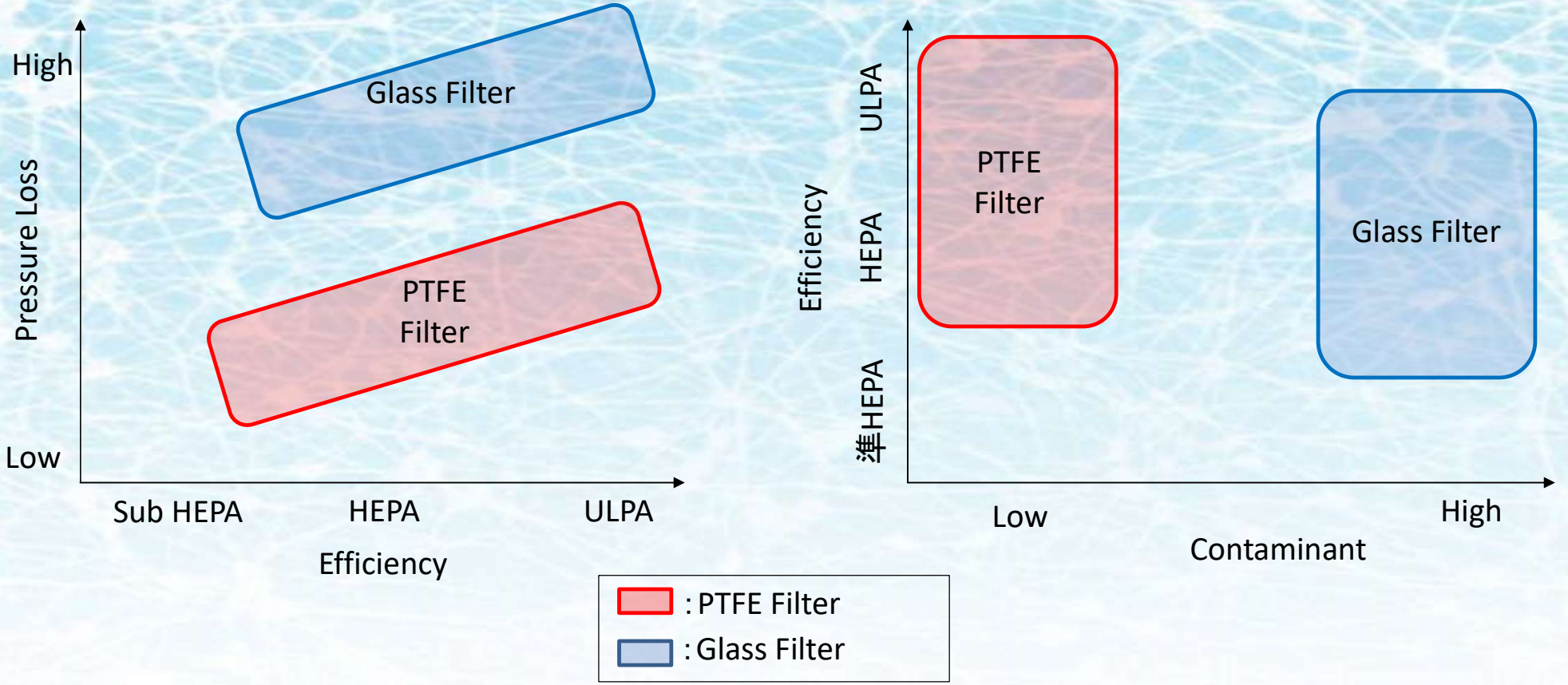
PTFE filter is the only material that satisfies all the properties required for high-performance air filters in a well- balanced manner.



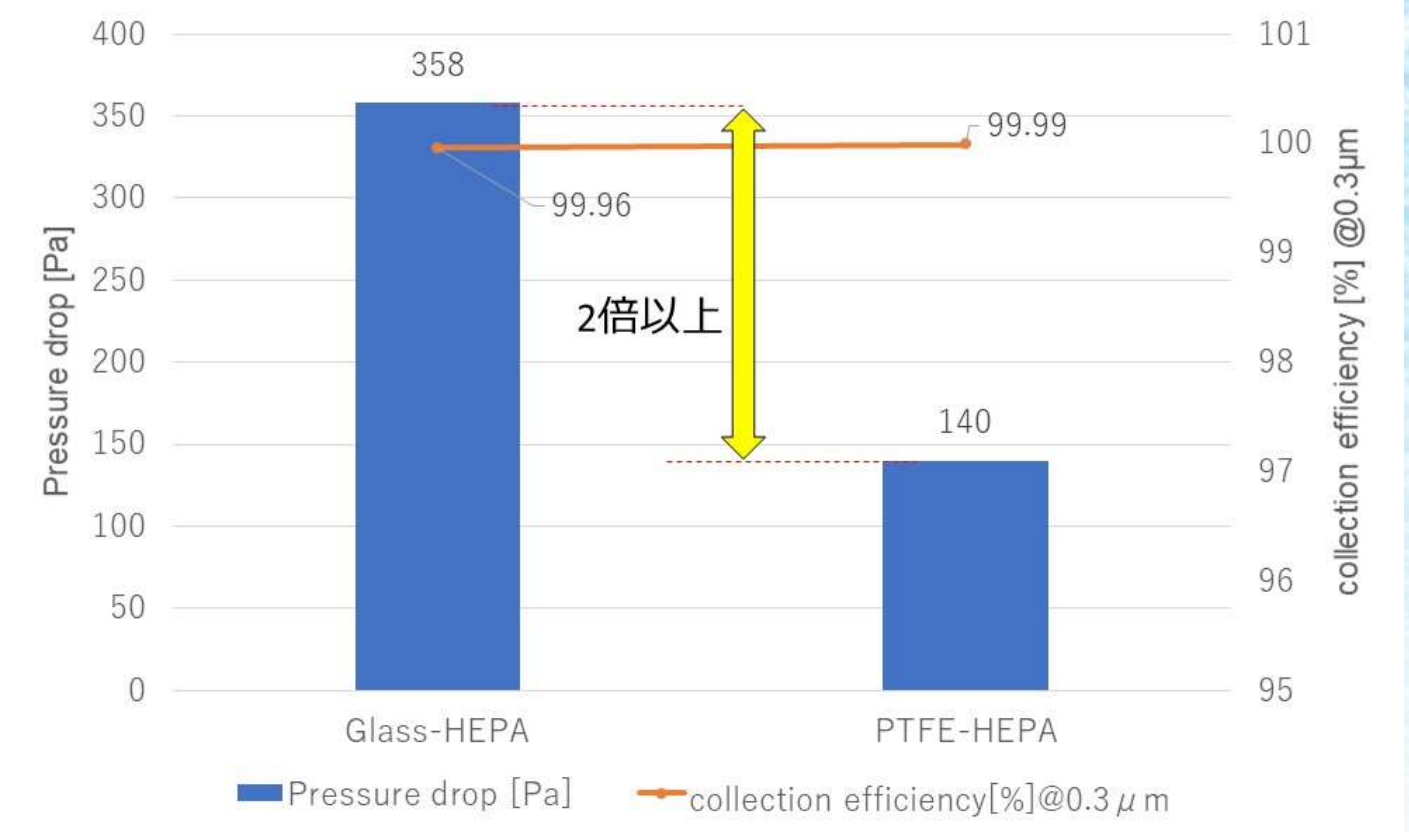
: PTFE Filter
: Glass Filter

Functions		PTFE filter	Glass filter
	Material	PTFE	Glass
Pressure drop		★★★★☆	★★☆☆☆
Environmental load (CO2 emissions equivalent)		★★★★☆	★★☆☆☆
Collection efficiency		★★★★★	★★★★★
Low impurity (Outgassing)		★★★★★	★★☆☆☆
Boron free		★★★★★	★★★☆☆

Characteristic comparison coverage area of air filters by material



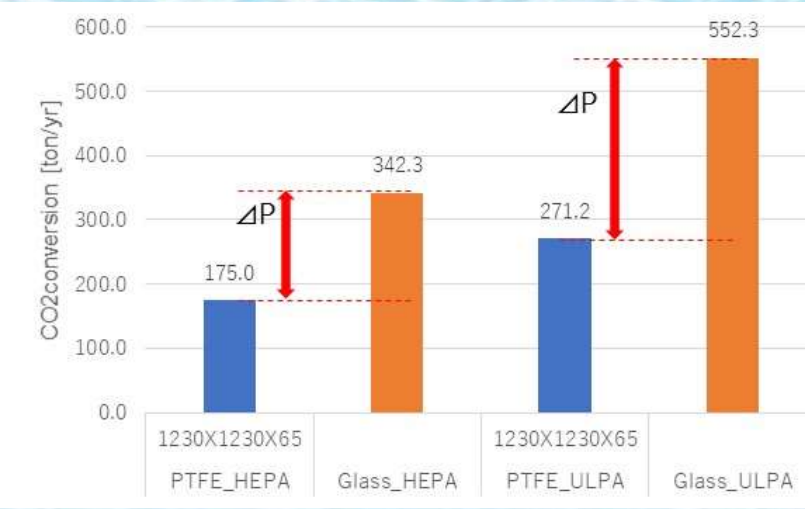
Pressure loss comparison



Glass-HEPA has almost the same collection efficiency as PTFE-HEPA, but the pressure loss is more than doubled.

CO2 emissions

Filter Grade		PTFE_HEPA	Glass_HEPA	PTFE_ULPA	Glass_ULPA
Filter Size	mm	1230X1230X65		1230X1230X65	
Q(Rated flow rate)	m3/min	40.0	40.0	40.0	40.0
Q(Rated flow rate)	m3/sec	0.67	0.67	0.67	0.67
ΔP(Pressure drop)	Pa	46.0	90.0	71.3	145.2
H(Operation time)	Hr	8760.0	8760.0	8760.0	8760.0
η(Airflow efficiency)	-	0.76	0.76	0.76	0.76
Power consumption※	kWh/yr	353.5	691.6	547.9	1115.7
CO_2 conversion※※/unit	kg/yr	175.0	342.3	271.2	552.3
(1000台設置換算)	ton/yr	175.0	342.3	271.2	552.3

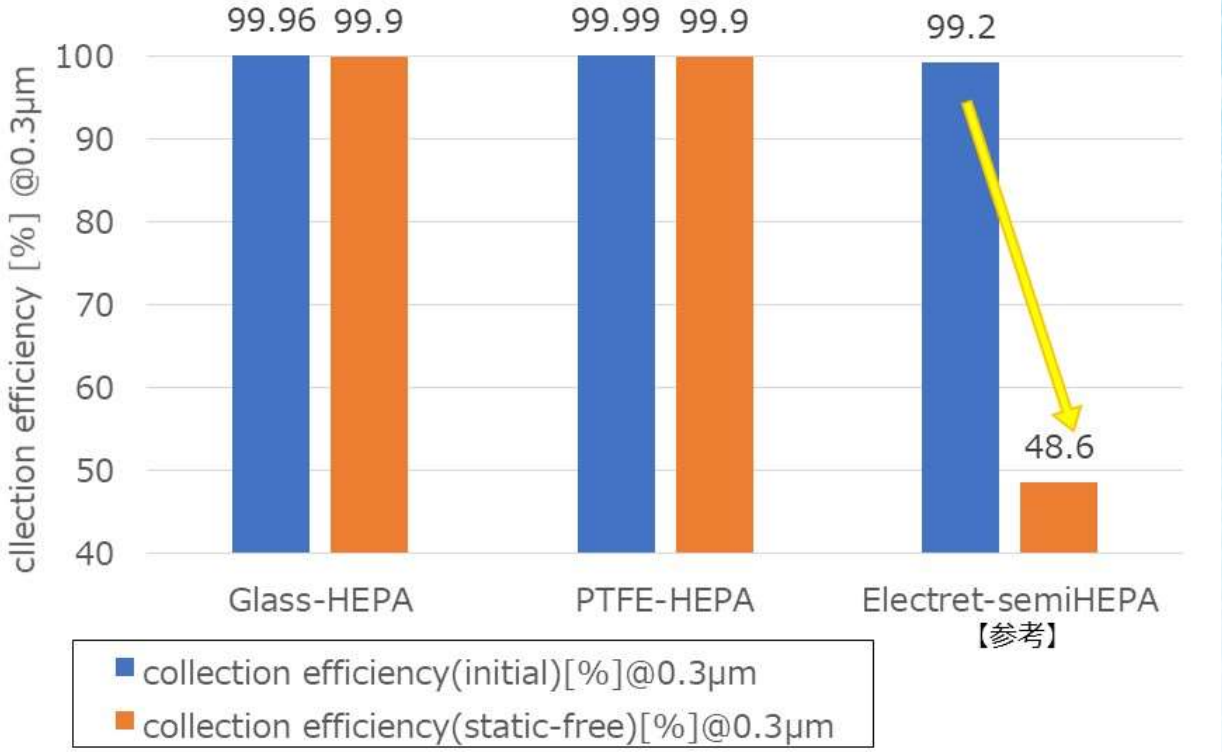


※Power consumption (kWh)=(QX⊿PXH)/(η X1000)
※※1kWh = 0.495 kgCO_2

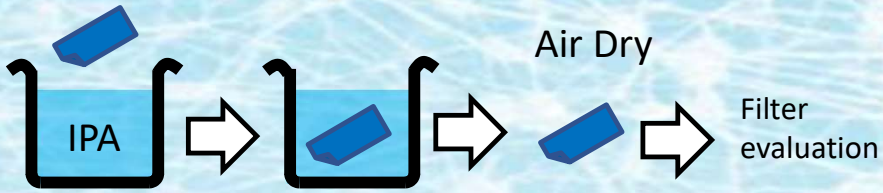
Converting power consumption to CO2 emissions based on Saitama Prefecture ordinance values.

When 1000 filters are operated for one year, the pressure loss difference is about 170 tons for HEPA type,The ULPA type emits about 270 tons of CO2 and has a large impact on the environment.

Performance persistence



Static elimination method (IPA immersion)



ISO16890-4
Minimum collection efficiency after static elimination is required according to the static elimination test method for ventilation air filter units.

There is no change in the collection efficiency of the glass filter and PTFE filter before and after static elimination.

Low impurities (Outgassing)

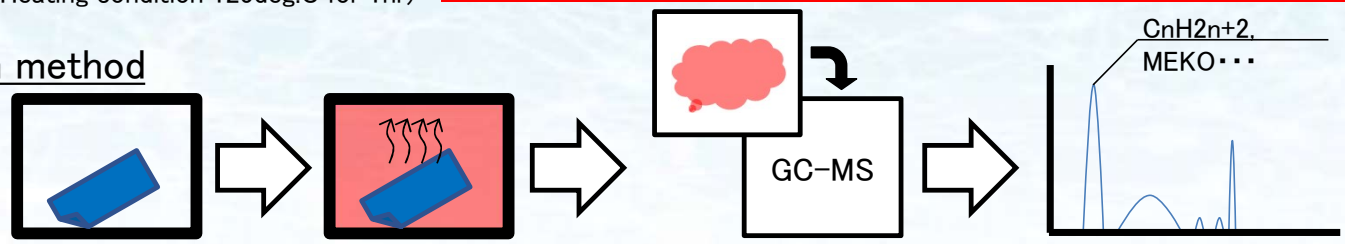
〈 Outgassing data 〉

Outgassing	PTFE filter	Normal Glass
Bibutyl Phthalate (DBP)	ND	1,100
Methyl Ethyl Ketone Oxime	ND	1,000
Methyl Isobutyl Ketone Oxime	ND	210
Fluoro Alkyl Alcohol	ND	1,240
Etc.	461	4,310
Amount of total outgassing [μg/m²]	461	**7,860**

※UNIT : μg/m²　　※ND : Not Detectable
※Method : GC-MS (Heating condition 125deg.C for 1hr)

Glass filters generate 10 times more outgassing than PTFE filters

Evaluation method



Low impurities (does not contain boron)

〈 Impurities Concentrations data 〉

UNIT:PPM

Element	B	Na	Mg	Al	K	Ca	Cr	Fe	Ni	Cu	Zn
PTFE filter	ND	2	ND	ND	23	ND	ND	ND	ND	ND	ND
Normal Glass	**53**	500	3.2	0.4	36	12	ND	ND	ND	ND	0.4
Low Boron Glass	**0.8**	2230	49	0.8	60	234	0.1	2.5	ND	0.1	4.4

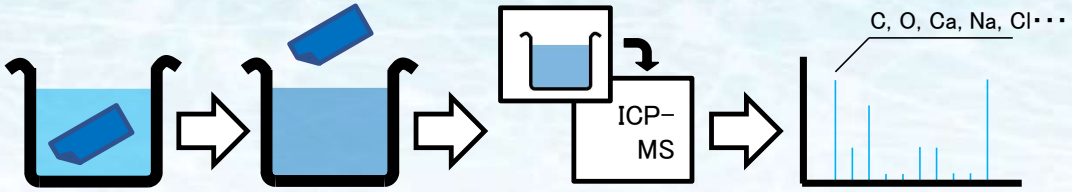
〈 Condition of Analisys〉

・Sample size: 20mm X 20mm/p

•Method : ICP-MS

1) Soaking in pure water(80ml)

2) Keeping for 3days at room temp.



Boron (B) is not detected from the PTFE filter, and the effect of contamination is smaller than that of the low-boron glass filter media.

Annual consumption (PTFE filter media)

PTFE filter media are used for particle filtration in air filters, but since they exist in fibrous form, their annual usage volume is small.

	(m^2)	※ PFAS含有量(kg)
2020年	309,066	361.6
2021年	549,160	642.5
2022年	648,066	758.2

※濾材重量　90g/m^2に含有するPFAS量が1.3%