

KEPITAL LOF Grade

(Low Emission POM for Automotive Interiors)

R&D Center

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1. Global VOC Standards Impact U.S. Tier Suppliers

- (1) Global Platforms produced by U.S. OEMs (Ford and GM) must meet country regulations in Korea and China
- (2) Vehicles exported to Korea and China will likely be required to meet strict local emission regulations in the future
- (3) Global OEMs in the EU (VW, Audi and BMW), and in Asia (Toyota, Nissan, Hyundai and Kia), apply their corporate standards worldwide
- (4) KEPITAL[®] LOF low emission POM meets the most stringent global auto interior VOC standards

**If you supply parts or components to global OEMs,
or to U.S. OEMs with global platforms,
you need to meet global VOC standards.**

2. KEPITAL[®] LOF POM Characteristics and Benefits

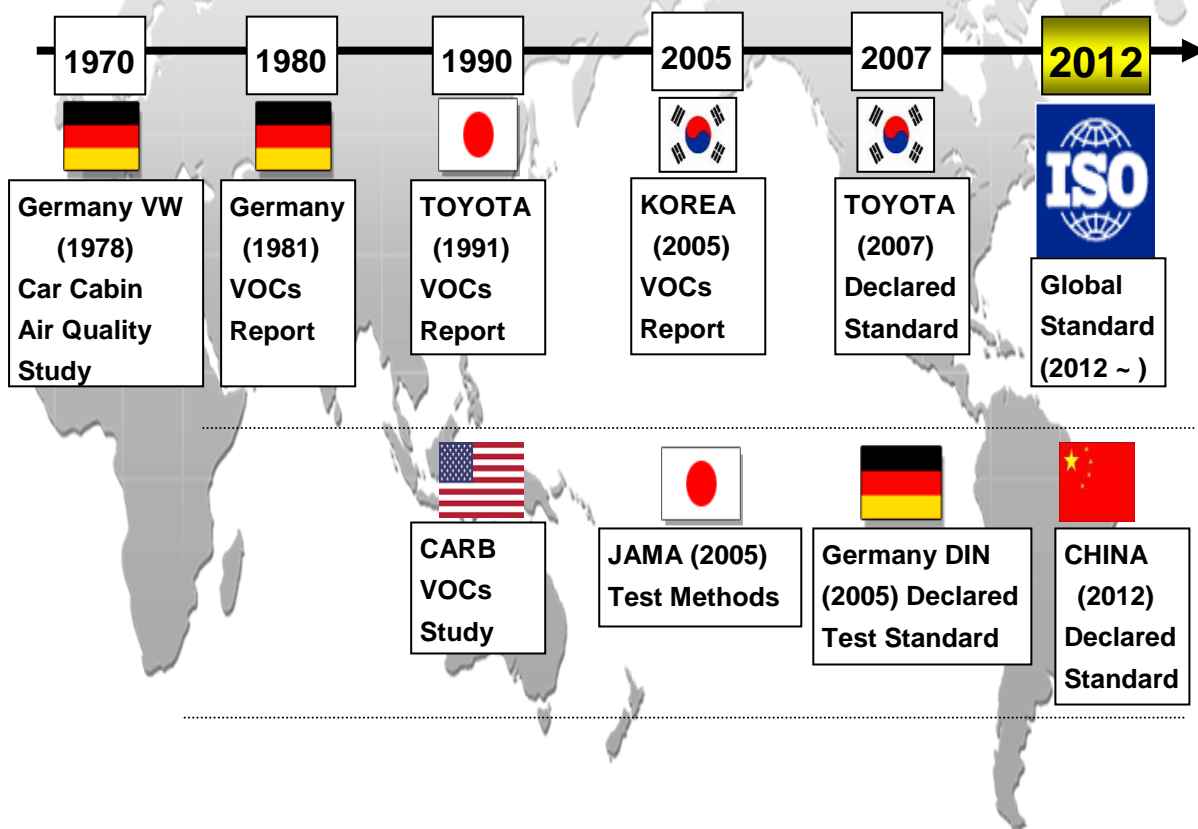
KEPITAL LOF POM Series

- (1) Minimizes VOC emission levels
- (2) Improves automotive interior environments, and can be used in Sanitation and other Industries requiring low emissions.
- (3) Significantly reduces emissions, while maintaining the inherent properties of POM Including high rigidity, wear resistance and durability.

**The KEPITAL LOF POM advantage :
⇒ You get lower emissions and great performance.**

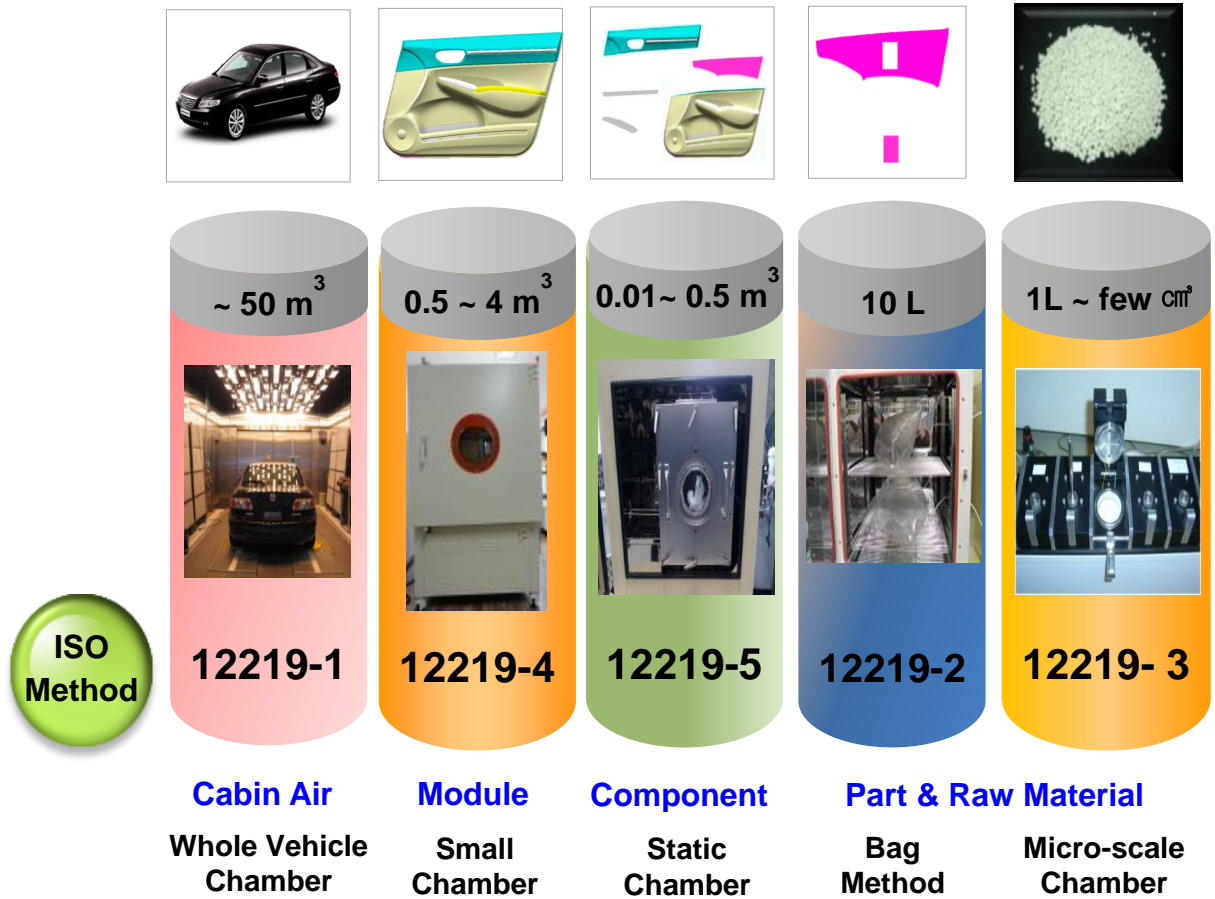
3. Evolution of Automotive Cabin Air Regulations & Guidelines

Low emission standards for countries and automotive OEMs



**OEMs and countries worldwide
are improving automotive interior air quality.**

3.1 ISO 12219 standard impacts auto interior emissions



ISO enacted specific test standards for auto interior components, parts and materials.

3.2 Regulatory criteria for interior automotive air quality by country

(Unit : $\mu\text{g}/\text{m}^3$)

Country	Formaldehyde	Benzene	Toluene	Xylene	Ethyl benzene	Styrene	Acrolein
KOREA	210	30	1,000	870	1,000	220	50
JAPAN	100	-	260	870	3,800	220	-
EUROPE	60	5	200			30	-
CHINA	100	110	1,100	1,500	1,500	260	-

KEPITAL LOF POM meets the most demanding guidelines and regulations for formaldehyde emissions.

		KOREA	CHINA	U.S.	EU
Supervision		Government	Government	*SAE J2989	VDA
Regulations		Recommendation	Guideline	Being developed	TUV Guide lines
Enforcement Date		July 2010 ~	The regulation will be published in 2016	Proposal for test draft	-
Date of VOC Evaluation		Within 4 weeks after production	-	-	-
Test Procedure	Stabilizing	12 hours, 25°C	6 hours, 25°C	Study to determine VOC test method	- (21°C)
	Ventilation	30 minutes			
	Test	Seal the car for 2 hours, 25°C → sampling	Seal the car for 16 hours, 25°C → sampling		

* SAE J2989 : Handling & Packing Materials and Components for Emission Testing

KEPITAL LOF POM meets the most demanding emission guidelines and regulations.

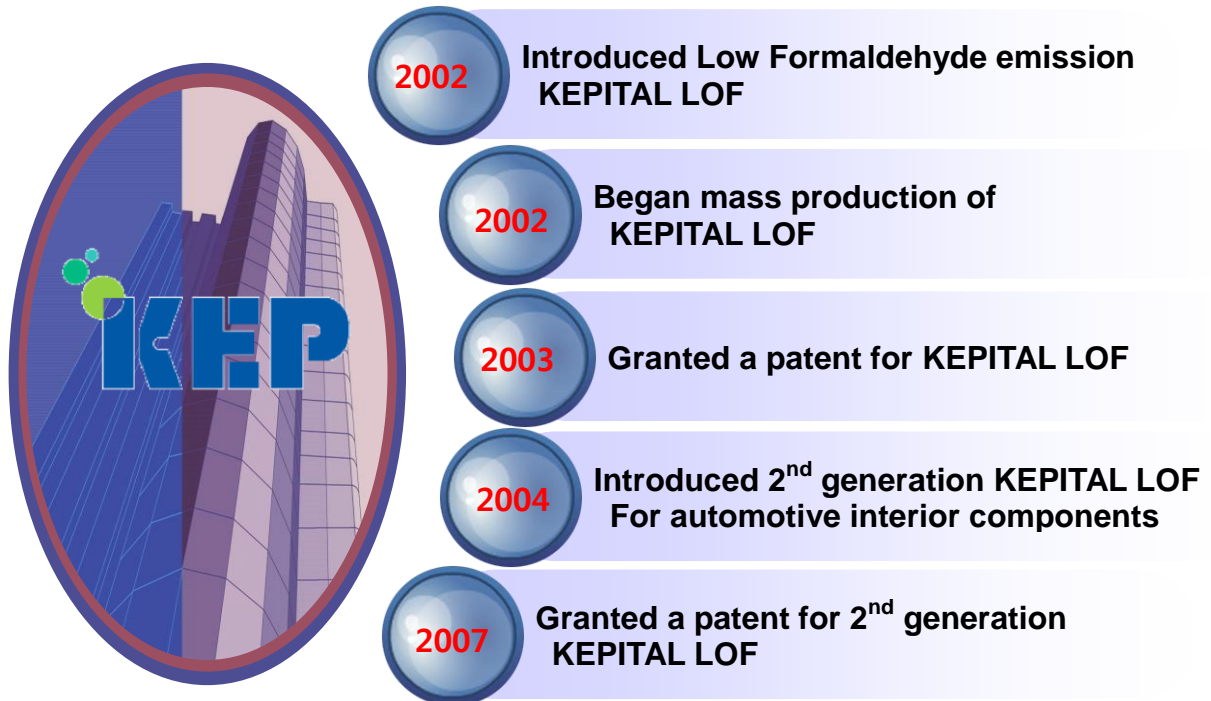
3.3 OEM component specifications for formaldehyde levels

Company	Formaldehyde	
	Specification	Method
HMC/KIA	$\leq 210 \text{ } \mu\text{g}/\text{m}^3$	MS 300-55
GM / GM Korea	$\leq 8 \text{ mg/kg}$	GMW 15635 (VDA 275)
BMW	$\leq 2 \text{ mg/kg}$	AA-0061 (VDA275)
VW	$\leq 5 \text{ mg/kg}$	PV 3925 (VDA 275)
AUDI		
FCA	$\leq 10 \text{ mg/kg}$	VDA 275
VOLVO		STD 1027, 2713 (VDA 275)
NISSAN	$30 \sim 500 \text{ } \mu\text{g}/\text{m}^3$	NES M0402

**OEM apply a variety of VOC standards,
KEPITAL LOF POM meets every one of them.**

4. Advanced KEPITAL LOF Products for Auto Interior Components

4.1 History of KEPITAL LOF POM technology



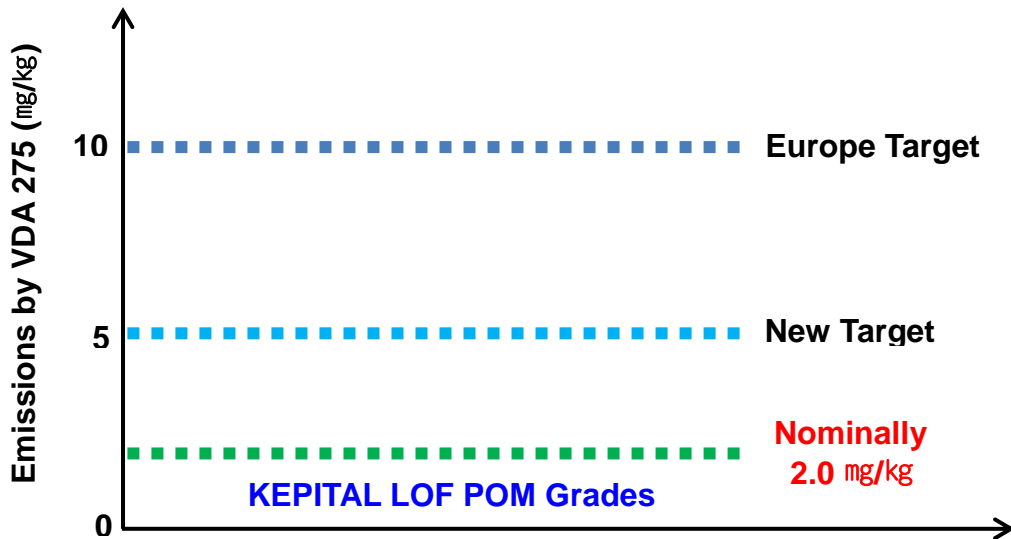
KEPITAL LOF POM has a proven track record backed by unique patented global technology.

4.2 Broad portfolio of KEPITAL LOF POM grades

Class.	KEPITAL LOF Grades	VDA275 Test result (mg/kg)
Standard (Unfilled)	F10-03H LOF, F25-03HT LOF	1.5
	F20-03 LOF, F30-03 LOF	1.0
UV-Stabilized	F20-52 LOF, F30-52 LOF, F20-52G LOF, F30-52G LOF	2.0
Impact Modified	TE-21 LOF, TE-22 LOF, TE-23 LOF, TE-24 LOF, TE-25 LOF, TE-33 LOF, TE-22S LOF, TE-23S LOF, ST-30 LOF, ST-50 LOF	2.0
Wear Resistant	TX-11H LOF, TX-21 LOF, TX-31 LOF, TS-22H LOF, TS-25A LOF, NX-20 LOF	2.0

All KEPITAL LOF POM grades meet global OEM requirements.

4.3 Market trends for low VOC auto interior materials



KEPITAL LOF POM meets the most rigorous "Gen. 2" OEM emission standards.

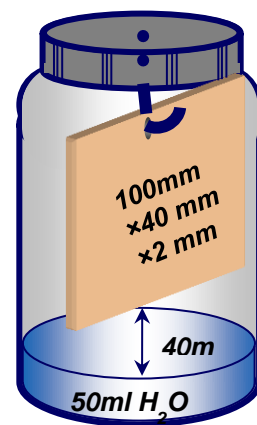
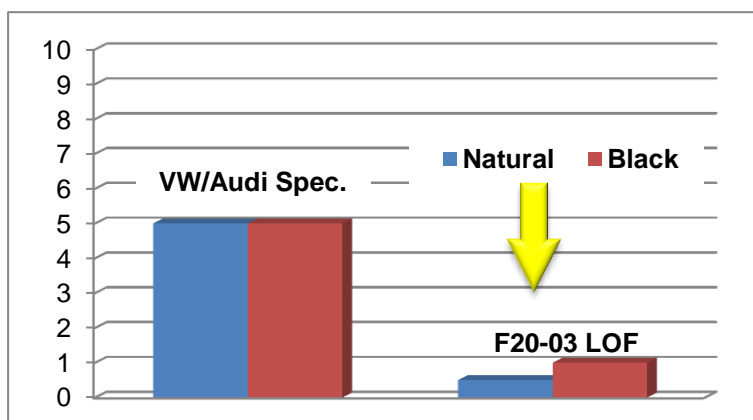
4.4 KEPITAL LOF POM performance vs. auto requirements

(1) Automaker requirements

Maker	VDA 275 (mg/kg)
VW	5 (natural, black)
Audi	5 (natural, black)
FCA	10 (natural, black)
Volvo	10 (natural, black)

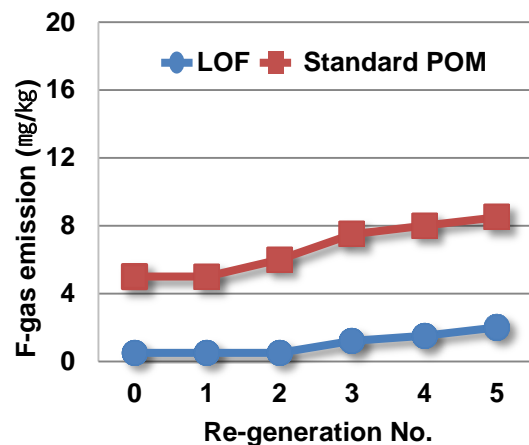
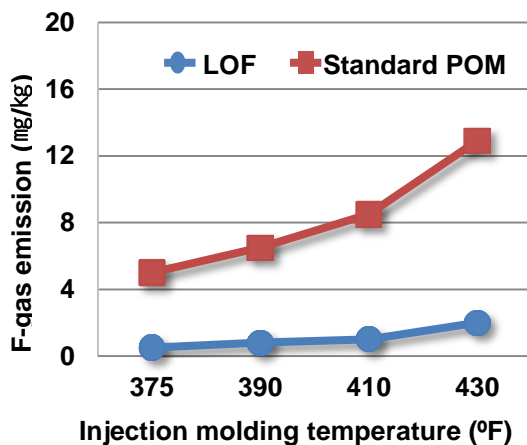
(2) KEPITAL F20-03 LOF formaldehyde emission level

※ VDA 275 test method



KEPITAL LOF POM grades meet global OEM emission requirements.

4.5 Optimized processing yields the lowest emission level



KEPITAL LOF POM gives you a broad processing window for consistent quality.

4.6 KEPITAL LOF POM automotive interior applications



Safety Belts
F10-03H LOF
F20-03 LOF
F20-52 LOF
TE-24 LOF
TS-25A LOF
ST-50 LOF



Height Adjustors
F10-03H LOF
TX-31 LOF
D-Ring
F10-52D LOF



HVAC
F20-03 LOF
FG2020L LOF



Fasteners & Clips
F20-03 LOF
TE-21 LOF
TE-22 LOF
TE-23 LOF
TE-24 LOF
TE-23S LOF

**KEPITAL LOF POM is being successfully applied
in a variety of global interior applications.**

5. Summary – Benefits of KEPITAL LOF POM

- 1. Gives you low emissions and the great performance of KEPITAL copolymer POM.**
- 2. Provides a wide processing window for consistent quality.**
- 3. Is an established product with a proven track record of successful applications backed by unique patented global technology.**
- 4. Our broad portfolio meets all global OEM low emission requirements, including demanding “Gen. 2” levels.**

**If you supply parts or components to global OEMs,
or to U.S. OEMs with global platforms,
you need KEPITAL LOF low emission POM.**

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