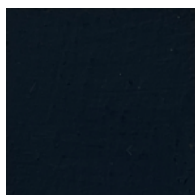




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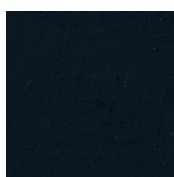
ParticleMax Getters (Vacuum Systems/Optical/MEMS/Hermetically Sealed Packages)

22mm × 22 mm



0.87" × 0.87"

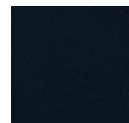
18mm × 18 mm



0.70" × 0.70"

ParticleMax Getters

12mm × 12 mm



0.50" × 0.50"

10mm × 10 mm



0.40" × 0.40"

NanoFEA (Nano Functional Engineering Atmospheres) has designed and developed a series of multifunctional nanomaterials for absorbing a variety of gases and particulate matter emissions from dedicated electronic devices, such as MEMS, optical, lithography equipment, medical, semiconductors, high-power laser, and photoelectronic packages. These hierarchically porous nanostructured materials, NanoMax, are specifically designed to absorb harmful gases and organic hydrocarbons and volatile compounds, as well as particulate matter. They are intended for use in demanding and challenging vacuum equipment or hermetic packaging systems. NanoMax material based particle getters offer a cost-effective particulate matter capture solution, which has been patented as disclosed in US Patent Application# 2025/0073666 A1 and 2025/0091030 A1.

The ParticleMax hierarchically porous nanostructured materials and getters provide a novel method for particle capture of magnetic, electric, dielectric, fine dust, foreign object debris, and microbial contaminants in vacuum system, optical, MEMS, and hermetic packaging systems. These harmful gas substances can impair device functions, and affect the reliability of long-term operation.

Benefits of ParticleMax Getters

- **Capable of capturing magnetic particles** (1-100 nm)
- **Capable of capturing electric particles** (1-200 nm)
- **Capable of capturing dielectric particles** (1- 200 nm)
- **Capable of capturing fine dusts and foreign object debris** (10-500 nm)
- **Capable of capturing microbial contaminants** (100-500 nm)
- **Capable of simultaneously capturing all above particles in one element** (1-500 nm)
- **Capable of adsorbing moisture** content from 10wt% to 20 wt%
- **Various Sizes:** Offers standard and custom sizes to fit any packaging requirement.
- **Lightweight and Low Profile:** Ensures excellent performance without adding bulk.
- **Easy Application:** Can be applied to any surface using high-temperature adhesive films or epoxy resins of your choice.
- **Wide Temperature Range:** Functions efficiently from -55°C to +300°C.
- **No Activation Required:** Ready to use without activation or regeneration.
- **Long Shelf Life:** Maintains effectiveness for up to 2 years from the date of purchase.

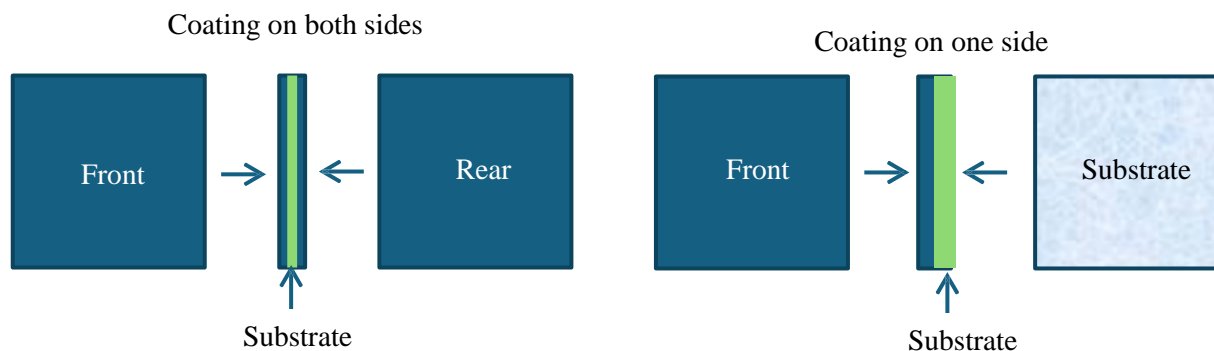
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ParticleMax Getters (Vacuum Systems/Optical/MEMS/Hermetically Sealed Packages)



Substrate materials: Glass (borosilicate glass and silicate glass), ceramics (alumina, purity 92-99%), metals (titanium (Ti), copper (Cu), Kovar alloy, aluminum alloy).

Material Physical Properties:

Density: $1.00 \pm 0.10 \text{ g/cm}^3$

Dielectric constant: 10.5 ± 0.5

Thermal conductivity: $1.4 \pm 0.1 \text{ W/m}\cdot\text{K}$

Coefficient of thermal expansion (CTE): 5–12 ppm/ $^{\circ}\text{C}$

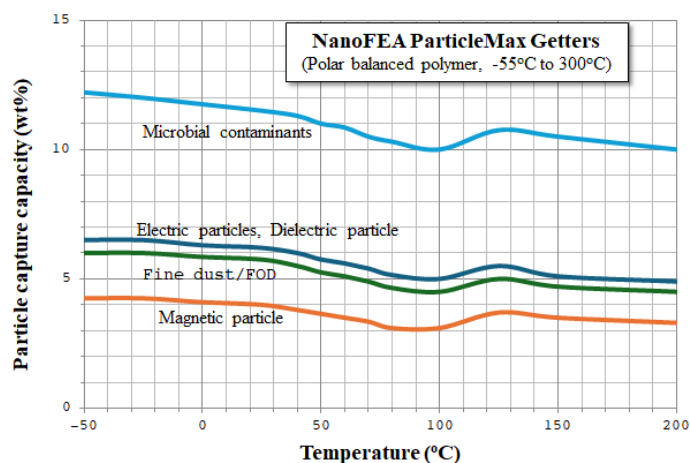
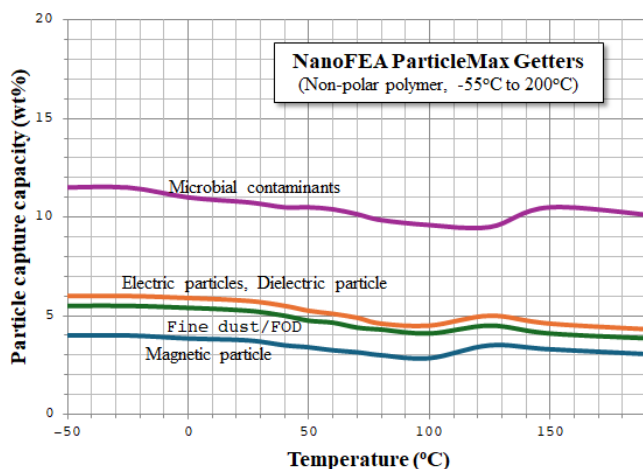
Young's modulus: 0.5-5.0 GPa

Hardness: 1.5-3.0 Mohs or 0.3- 1.0 GPa

Electric Insulation resistance: $10^9 - 10^{12} \Omega\cdot\text{cm}$

Surface energy: 25-35 mJ/m²

The appearance of the material: Likely white to off-white, with a matte, slightly porous texture



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ParticleMax Getters

(Vacuum Systems/Optical/MEMS/Hermetically Sealed Packages)

The size and thickness of a getter are determined by its length, width, and thickness. As shown in the table below, standard getter dimensions include 0.87" × 0.87" (22 mm × 22 mm), 0.70" × 0.70" (18 mm × 18 mm), 0.50" × 0.50" (12 mm × 12 mm), and 0.40" × 0.40" (10 mm × 10 mm). Customized sizes are also available upon request. The adsorbing material typically comes in two thicknesses: 350 ± 10 μm for double-sided coatings on the substrate, and 300 ± 10 μm for single-sided coatings. For example, if the adsorption capacities for particles and moisture are known to be 5wt% and 20 wt%, respectively, a getter with dimensions of 0.87" × 0.87" can adsorb 1.5 mg of particles and 15 mg of moisture. To ensure a safety factor of 10, an electronic package may allow a maximum outgassing quantity of 0.15 mg of particles and 1.5mg of moisture over 20 years of operation. The actual adsorption quantity is determined by the capacity at a specific temperature, humidity, and partial pressure.

Standard Getter Sizes	Type of Getter Coating	Adsorption Material Weight (mg)	Adsorption Layer Thickness (μm)	Getter Weight (g)	Getter Thickness (μm)	5 wt% Particle Adsorption (mg)	20 wt% Moisture Adsorption (mg)
0.87"x0.87"	Double sides	75	150	0.285±0.005	350±10	1.5	15.0
	Single-side	50	100	0.260±0.005	300±10	1.0	10.0
0.70"x0.70"	Double sides	50	150	0.200±0.005	350±10	1.0	10.0
	Single-side	35	100	0.185±0.005	300±10	0.7	7.0
0.50"x0.50"	Double sides	25	150	0.096±0.005	350±10	0.5	5.0
	Single-side	15	100	0.086±0.005	300±10	0.3	3.0
0.40"x0.40"	Double sides	15	150	0.065±0.005	350±10	0.3	3.0
	Single-side	10	100	0.060±0.005	300±10	0.2	2.0

Particle Getter Sensitivity and Adsorption Capacity

Package Emission	Type of Emission	-55°C to 125°C	-55°C to 200°C	-55°C to 300°C
Particulate Matter	Electric Particles (μg/cm ²)	27.1	6.2	6
	Magnetic Particles (μg/cm ²)	51.3	5.7	5.5
	Dielectric Particles (μg/cm ²)	45.5	6	5.8
	Fine dust/FOD Particles (μg/cm ²)	50.3	7.2	7
	Microbial Contaminants (μg/cm ²)	69.6	8.2	7.8
Moisture/Water Vapor	Adsorption Capacity (wt%)	10-20	5-10	1-5
Polymer Matrix Material		Polar Polymer	Non-polar Polymer	Polar Balanced Polymer

Pre-use preparation: To eliminate adsorbed moisture from the getter prior to package installation, heat the getter at 80–100°C for 24–72 hours under vacuum conditions (<10⁻⁵ Torr). After this treatment, perform a dry N₂ or Ar purge to prevent re-adsorption of moisture before assembly.