Dexerials' Functional Materials

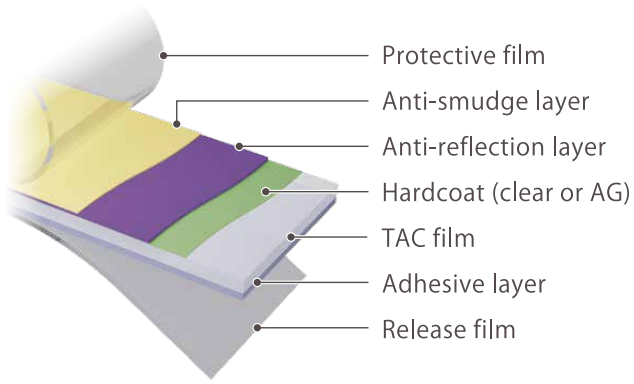
Dexerials Corporation

Anti-reflection film with low reflectivity and high abrasion resistance. Inorganic thin films are used to prevent reflection.

Anti-reflection film

- Inorganic films with different refractive indices are precisely laminated by the sputtering method, which can control film thickness at the nanoscale; this provides a high anti-reflection property in the visible light range as well as abrasion resistance.
- Because even the slightest amount of reflected light affects display surface quality, we prepare products with different gloss impressions.
- The anti-smudge layer that is formed on the outermost surface by vacuum deposition repels fingerprints and makes it easy to wipe them off in order to maintain the display's function for a long time.

Product structure

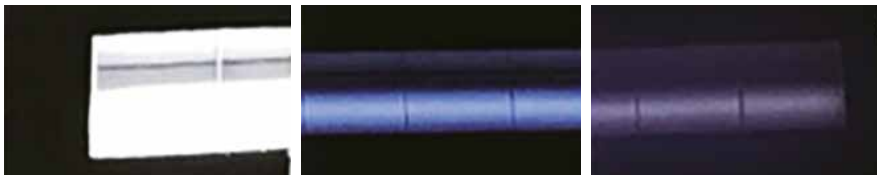


Example applications

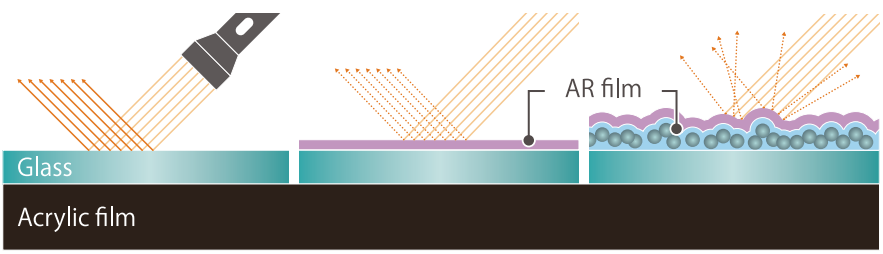
Displays for electronic devices such as monitors, laptop PCs, and smartphones

Reduced reflection effect

Reflected image of a fluorescent lamp on glass or film

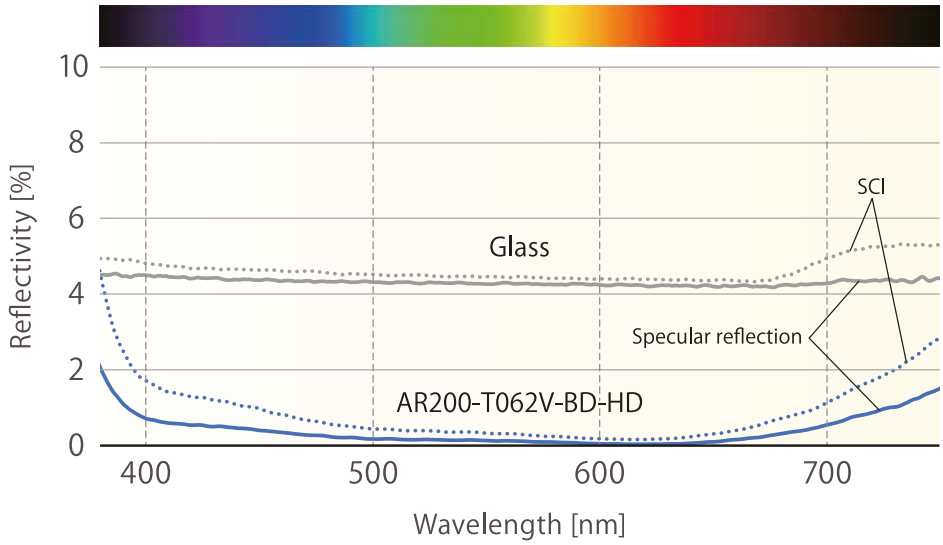


Glass | Clear + low reflection | AG + low reflection

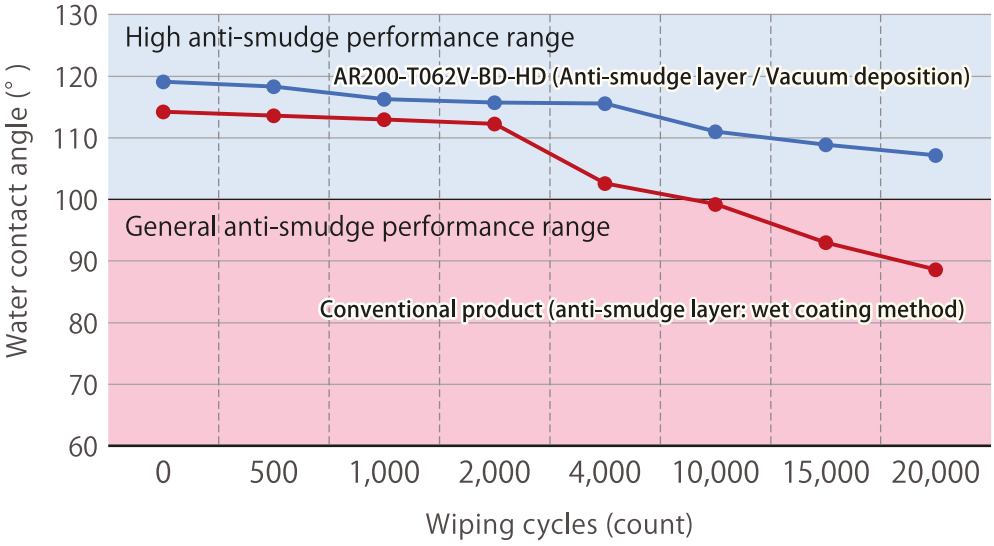


Reflection spectrum

(Test conditions)
Evaluation method:
Instrument: U-4150 (Hitachi High-Tech Corporation)



Anti-smudge performance (repeated wiping test using nonwoven fabric)



[Test conditions]
Load: 250 g
Tool dimensions: 2 cm x 2 cm

Product lineup

		Clear type	AG (anti-glare) type		
Product name		AR200-T081V-JD-HD	AR200-T082V-AD-HD	AR200-T062V-BD-HD	Test conditions
Luminous reflectance (Y) *1 [%]		0.18 / 0.32 *2	0.18 / 0.35 *2	0.1 / 0.32 *2	JIS Z8701
Reflective hue*1	a*	1.4 / 2.0 *2	1.1 / 1.2 *2	0.0 / 0.7 *2	JIS Z8781
	b*	−6.3 / −7.5 *2	−2.3 / −6.1 *2	−1.5 / −4.4 *2	JIS Z8781
Haze [%]		0.3	4.5	12.6	JIS K7105-6.4
Total light transmittance [%]		96.4	95.1	95.8	JIS K7105-5.5
Abrasion resistance		No scratches	No scratches	No scratches	Steel wool test 1000gf x 150
Contact angle [°]		117.5	118.9	118.5	JIS R3257

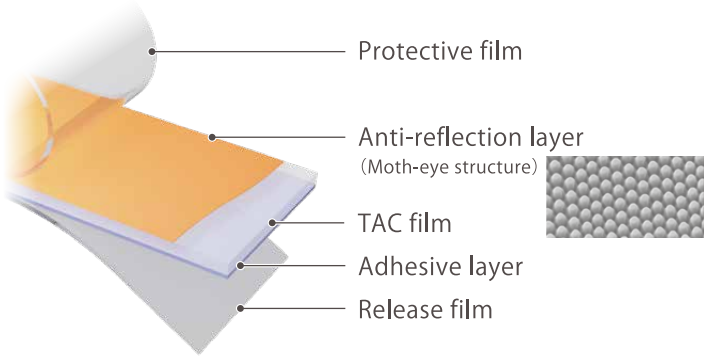
*1 : Specular Component Include
*2 : Regular reflection/Total reflection

Optical film that provides low reflectivity and high transmissivity with a nanometer-scale fine moth-eye type structure formed on the film surface

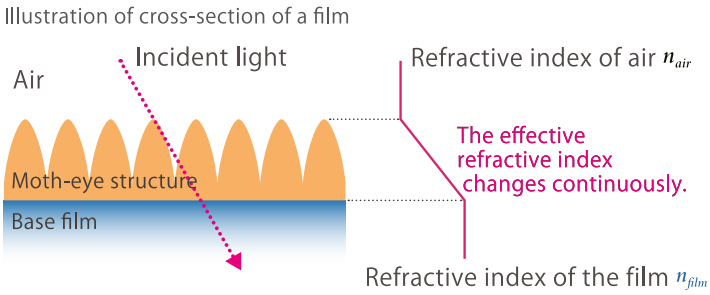
Anti-reflection film Moth-eye type

- This film exhibits excellently low reflectivity over a wide wavelength range from visible light to near infrared. It can be placed in front of an IR sensor.
- It exhibits excellently low reflectivity also for diagonally incident light, which enables suppressing ghost images due to multiple reflections.
- It provides a film texture that eliminates a feeling of film by giving a neutral hue to extremely slight reflected light.

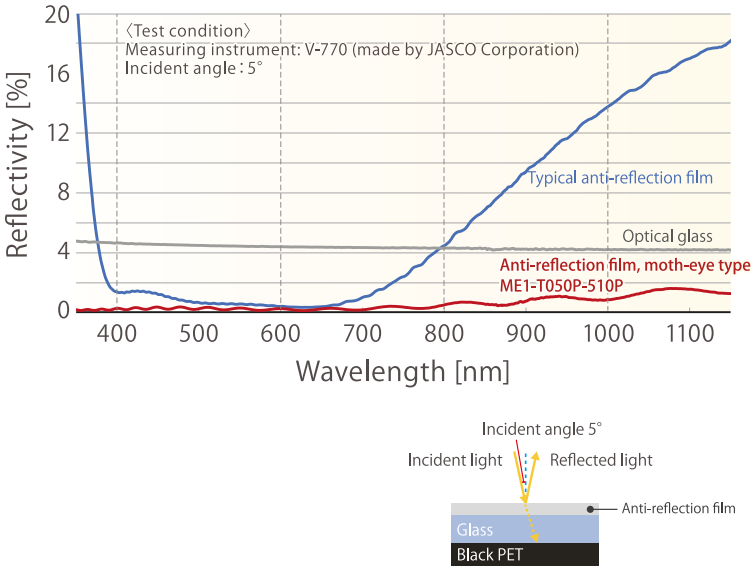
Product structure (ME1-T050P-510P)



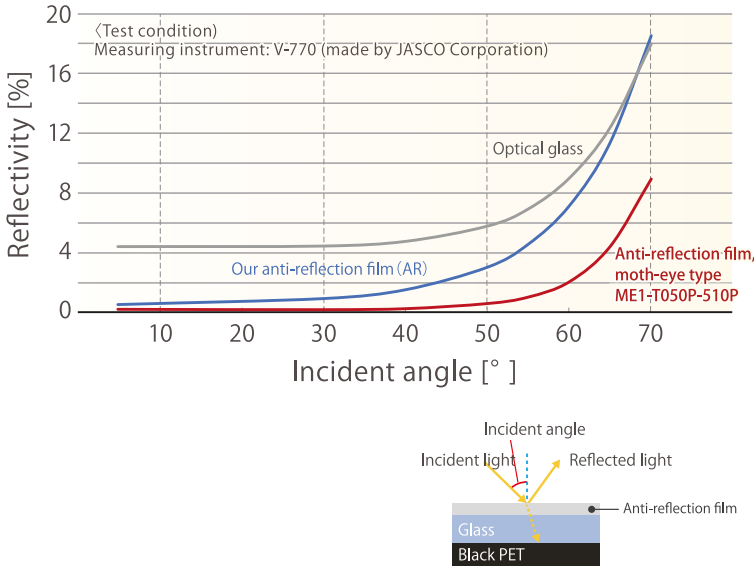
Principle of reducing reflections



Reflection spectrum



Reflectivity for diagonally incident light



Product lineup

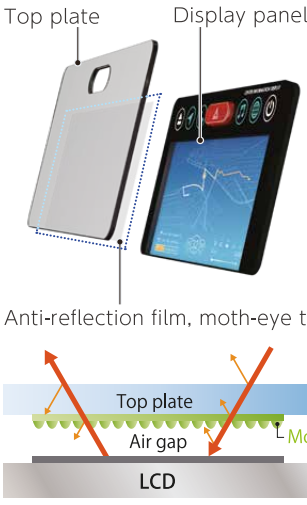
		Single-sided moth-eye type (with an adhesive layer)	Double-sided moth-eye type (with no adhesive layer)		
Product name		ME1-T050P-510P	ME2-C1500 *3	ME2-M1000 *3	ME2-M1800 *3
Luminous reflectance *1 [%]		0.2	0.6	0.7	0.8
Reflective hue*1	a*	0.3	–	–	–
	b*	0.3	–	–	–
Transmissive hue*1	a*	0.0	0.0	0.0	0.0
	b*	0.3	0.1	0.2	0.5
Haze*2 [%]		0.2	0.2	0.2	0.3
Total light transmittance [%]		95.3	99.3	98.9	98.6

*1 : Measuring instrument : V-650 (JASCO); incident angle: 5 deg (reflection), 0 deg (transmission); light source: D65
*2 : Measuring instrument : HM-150 (Murakami Color Research Laboratory); testing standard: JIS K7136 (ISO 14782) (Haze), JIS K7361 (ISO 13468-1) (Transmissivity)
*3 : ME2-C1500 (base material: PC, 0.16-mm thick), ME2-M1000 (base material: PET, 0.11-mm thick), ME2-M1800 (base material: PET, 0.19-mm thick)

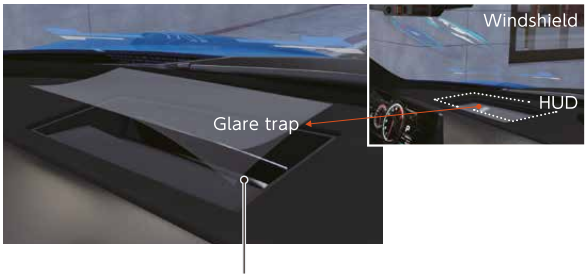
Applications

(Single-sided moth-eye type) e.g. automotive displays, and head-up displays (HUDs)

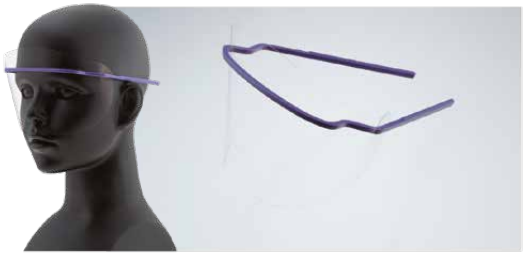
Automotive display



Automotive head-up display



(Double-sided moth-eye type) e.g. disposable eye shields, and eye-shields with a mask



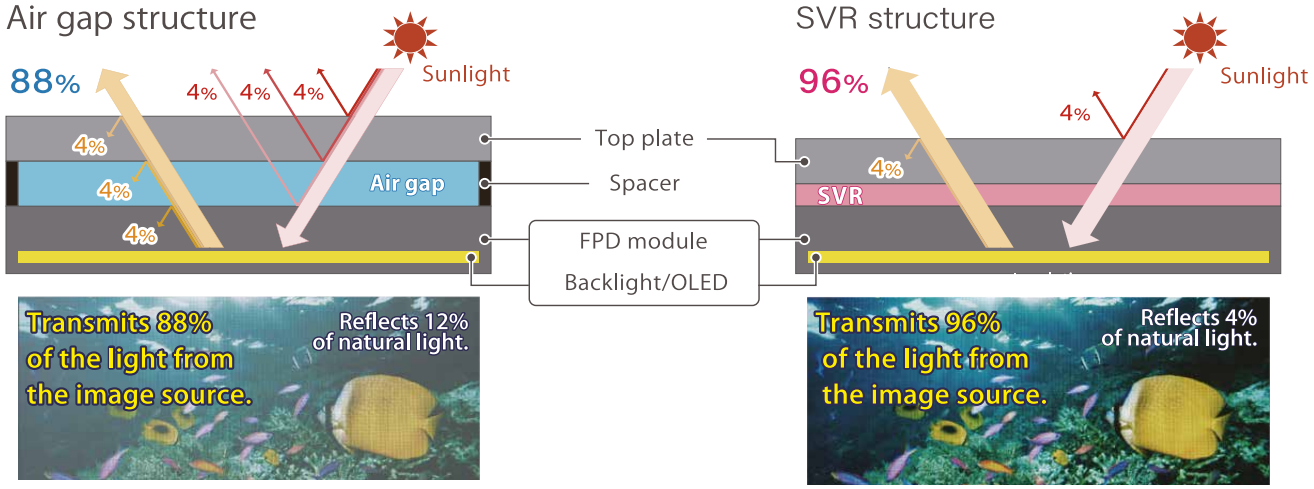
(Photograph)
Using a general frame
ME2-C1500 (film material: polycarbonate)

Optical clear resin (OCR/LOCA) that improves display visibility, reducing optical reflection/loss by filling the space in the display

Optical elastic resin （SVR）

- Optical outputting efficiency is maximized by adjusting the resin's refractive index to that of a transparent plate (e.g., a glass plate or plastic plate used as the top plate).
- This resin exhibits low elasticity after lamination (curing) to improve panel rigidity, thus enabling the panel to be made thin while maintaining rigidity.
- Making the most of the properties of liquid resin, we offer three types of coating methods. They can be flexibly applied to any type of process to produce displays of various shapes.

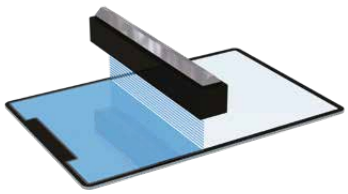
Improving visibility/contrast



Resin coating processes for various display shapes

Inkjet coating

Jettable SVR

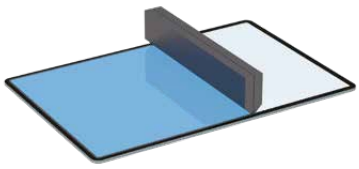


As coating shape can be controlled in the software, in addition to quadrilaterals, various coating shapes are possible.

Examples:
Smartphone displays that have a notch and camera holes

Slit coating

Hybrid SVR



While this method offers excellent coating efficiency, the coating shape is limited to a quadrilateral due to the slit coating.

Examples:
Quadrilateral displays of devices such as laptop PCs, tablet PCs, and car navigation systems

Dispenser coating

SVR

Although the coating shape must be controlled, this method has the highest versatility.

Product lineup (examples)

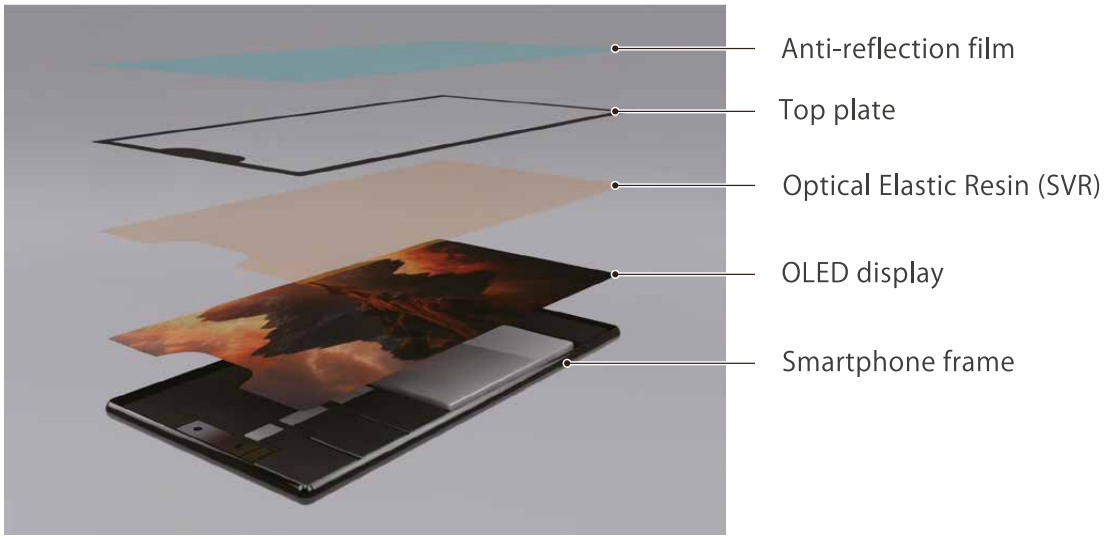
		Inkjet coating	Slit coating	Slit coating
Product name		Jettable SVR	HSVR330	SVR6000
Curing conditions [mJ/cm^2]		Pre-curing 500 – 1,000 *5	Pre-curing 500-1,400 *5	≧ 2,000 *6
		Full-curing ≧ 1,000 *5 *6	Full-curing ≧ 1,000 *6	
Viscosity*1 [mPa・s]		10 – 30	5,300	3,300
Cured product	Hardness*2	E15 – E40	E12	E12
	Refractive index*3	1.45 – 1.49	1.48	1.46
	Elastic modulus*4 [MPa]	0.01 – 1.0	1.2	0.66
Storage temperature [°C]		10 – 30	10 - 30	10 - 30

*1 : Rheo-meter @25°C
*2 : Durometer (Code E)
*3 : Abbe @25 ℃, D-line (589nm)
*4 : DMS method @1Hz (25℃)
*5 : LED 365 nm
*6 : Metal-halide lamp

Example applications

Displays of electronic devices such as laptop PCs, tablet PCs, mobile gaming devices, smartphones, and smartwatches

Use example (SVR employed for an OLED display)

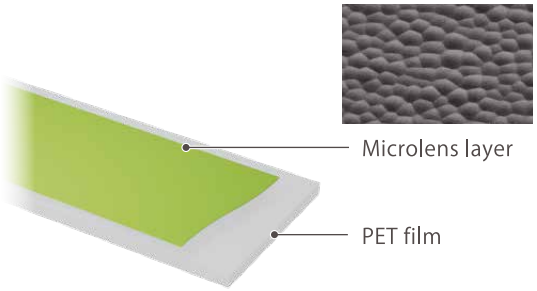


Optical film that provides a plane light source with high brightness and reduced luminance nonuniformity by diffusing light distribution of parallel light in a top-hat shape

Diffusive Microlens Array

- Diffusing the light intensity distribution of parallel light in a top-hat shape provides a plane light source that is optimal for projection equipment.
- A top-hat intensity distribution is used to reduce luminance nonuniformity.
- Making a light distribution that suppresses brightness reduction by preventing light from escaping outside the range realizes a high efficiency light source.

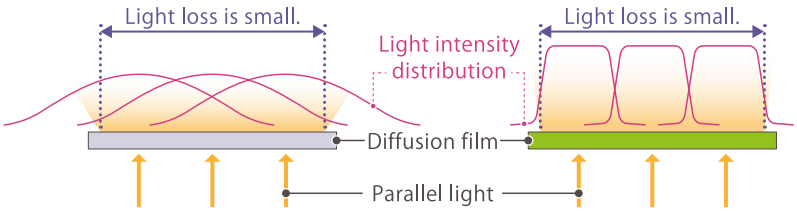
Product structure



* Products are processed into usable forms before shipment.

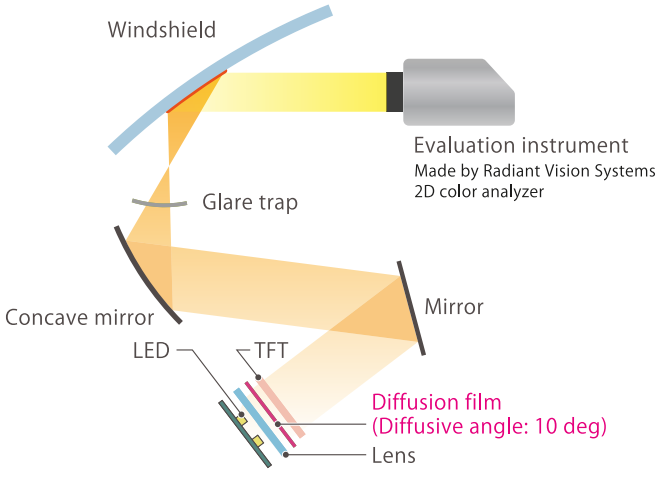
Comparison of diffusion films for light distribution

Typical diffusion film (microparticle coating type)	Diffusive Microlens Array
Diffused in a normal light distribution (Gaussian distribution)	Top-hat light distribution Light loss is small.
Light leaks outside the range (loss occurs).	



Verification of effects

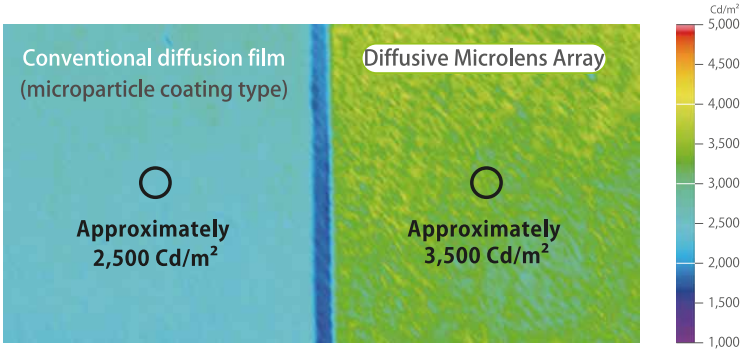
Schematic diagram of optics used for verification



Light intensity evaluation

Using optics that assumes an automotive heads-up display (HUD) (left figure), it uses the color analyzer to measure the light intensity distribution of the image (white) projected onto the glass.

The light intensity increased by about 40% compared to a conventional diffusion film.

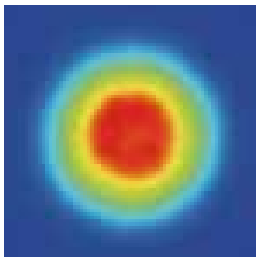


Product characteristics

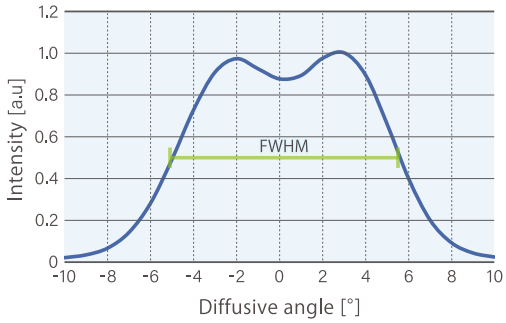
Product name	DMLA
Base material	PET
Thickness (mm)	0.1
Size (mm)	200 × 400
Diffusive angle (FWHM)*1 (°)	10
Beam shape*2 / Diffusion property*3	Circular / Top-hat type
Total transmittance*4 (%)	≧ 85

*1: FWHM (Full-Width Half-Maximum), design value

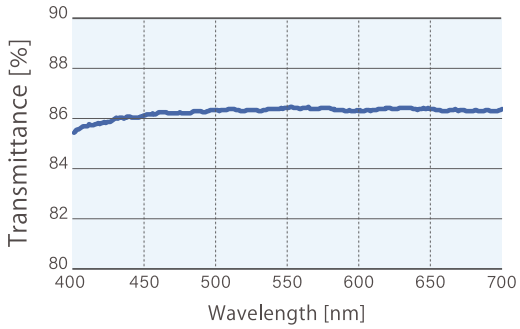
Beam shape*2



Diffusion property*3



Transmittance*4

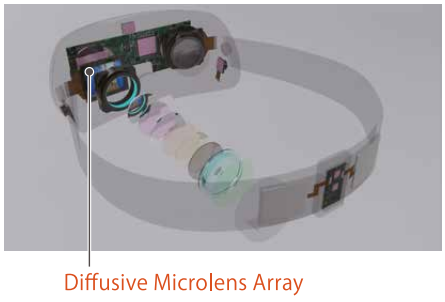


* If parallel light (collimated light) is incident.

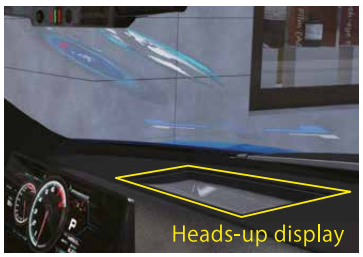
Example applications

XR devices, heads-up displays (HUDs), and projection light source equipment such as projectors

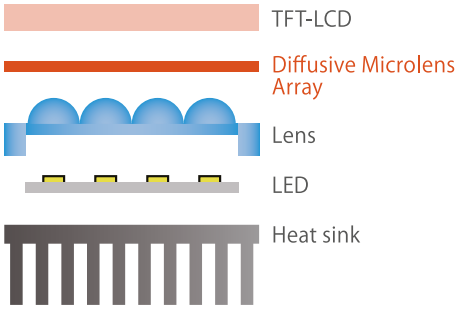
VR goggles



Heads-up display



Projector configuration



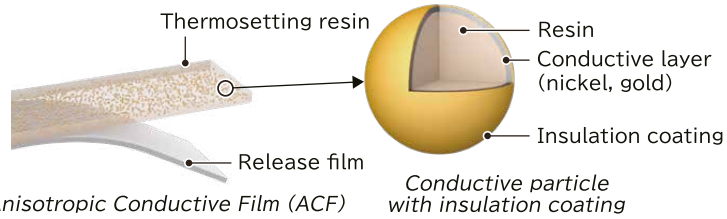
Fine conductive particles dispersed in adhesive films enable fine-pitch connections and low-transmission-loss circuit connections.

Anisotropic Conductive Film (ACF)

- A simple connection structure with short connection lengths enables transmission loss to be reduced.
- Enables fine-pitch connections* to miniaturize components with many terminals and to make mounting areas smaller.
- The film thickness is less than 50 μm*, and the resin works as underfill, enabling reliable low-height mounting.
- Mounting can be performed at a temperature lower than that for reflow soldering, making it possible to mount components with low heat resistance.

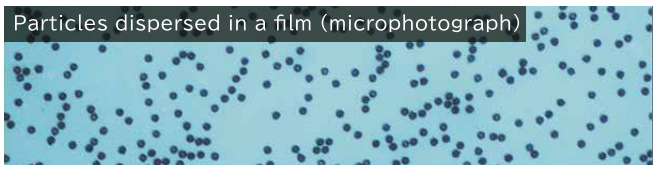
* Available pitches and film thicknesses depend on the application.

Product structure



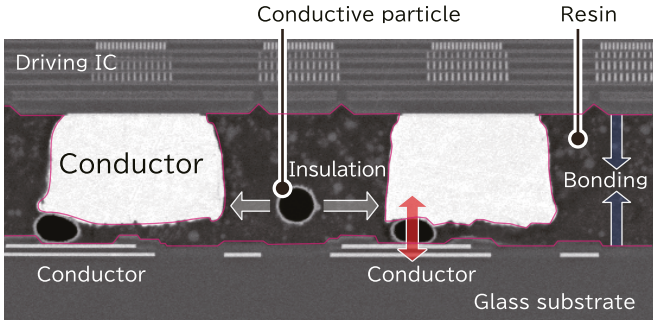
Anisotropic Conductive Film (ACF)

Conductive particle with insulation coating

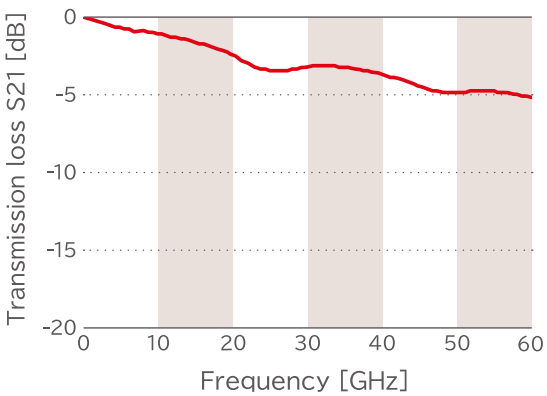


Example connection structure

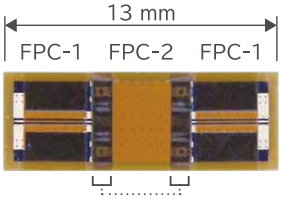
Cross-sectional image of the connection structure when a display driving IC is mounted on a glass substrate



Transmission characteristics of ACF bonding section ("transmission characteristics")



[Test piece for evaluating transmission characteristics (appearance)]



ACF connection areas (each 1-mm wide)

Cross section of test piece for evaluation

Connection conditions

Product name	CP883TX-25
Temperature	180 °C
Pressure	3 MPa
Time	15 sec.

Product lineup (example)

		Alternatives to soldering/connectors		For displays		For touch panels/sensors/batteries	
Product name		CP801AM-35AC / 45AC	DP3342MS	CP540SA-18AJ	CP883TX-25AJ	CP990AM-25AC	CP990CM-25AC
Type		FOF / FOB	FOF / FOB	COG	FOG	FOP	FOP / Battery connection
Connection material		FPC	FPC	IC	FPC	FPC	FPC/Battery
		PWB	PWB	Glass substrate	Glass substrate	Plastic substrate	Plastic substrate/PWB
Minimum space [μm] *1		100	100	12	25	50	150
Minimum connection area [μm²] *2		100,000	100,000	500	12,000	60,000	200,000
Thickness [μm]		35 / 45	35	18	25	25	25
Conductive particle	Type	Gold/nickel plating on polymer particle		Nickel plating on polymer particle		Gold/nickel plating on polymer particle	
	Particle diameter [μmϕ]	10	10	3.0 – 3.2	4	10	20
	Particle with insulation coating	–	–	○	–	–	–
Main bonding conditions	Temperature [°C]	180 – 200	130 – 160	130 – 160	180 – 200	140 – 160	130 – 160
	Time [sec]	10 – 5	6	5	8	5	10
	Pressure*3 [MPa]	2 – 4	1 – 4	40 – 80	3 – 5	2 – 4	0.5 – 4

*1: Minimum space: The space between adjacent circuits

*2: Regarding σ-value control of the minimum connection area, contact us per product.

*3: Main bonding pressure: The pressure for COG was calculated from the total bump area. The pressures for FOG, FOB, and FOF processes were calculated from the bonding areas.

Example applications

Mounting components in electronic devices such as monitors, laptop PCs, tablet PCs, smartphones, smartwatches, head-mounted displays, and smart glasses

Arraying conductive particles enables fine-pitch connection with a minimum wiring space of 5 μm

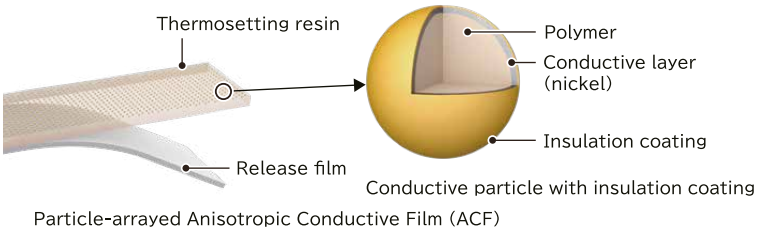
Particle-arrayed Anisotropic Conductive Film (ACF)

ArrayFIX

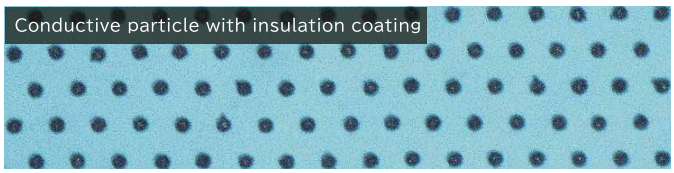
- By arraying particles at the designed location, our original newly developed resin keeps the particles from moving around during the bonding process. Trapping a stable number of particles can achieve stable conductivity.
- The increased particle trapping efficiency secures stable conductivity with fewer particles, which decreases the number of particles between adjacent circuits to reduce the risk of short-circuits.
- While maintaining the properties of conventional ACF, this new ACF enables connections with even smaller pitches*.(Enables interconnection with a minimum wiring space of 5 μm in the COG process)

* Available pitches and film thicknesses depend on the application.

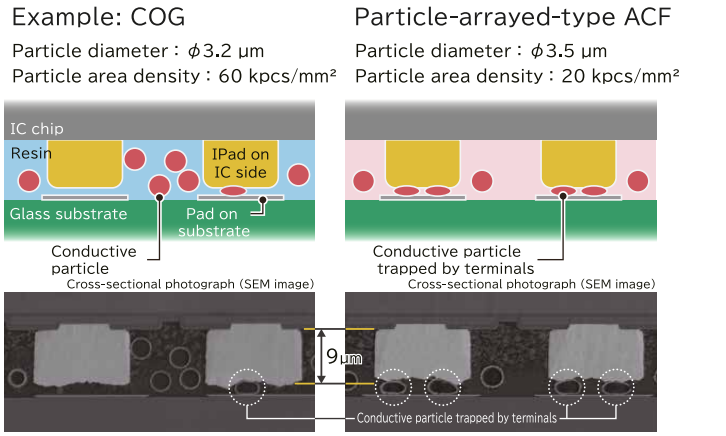
Product structure



Particle-arrayed Anisotropic Conductive Film (ACF)

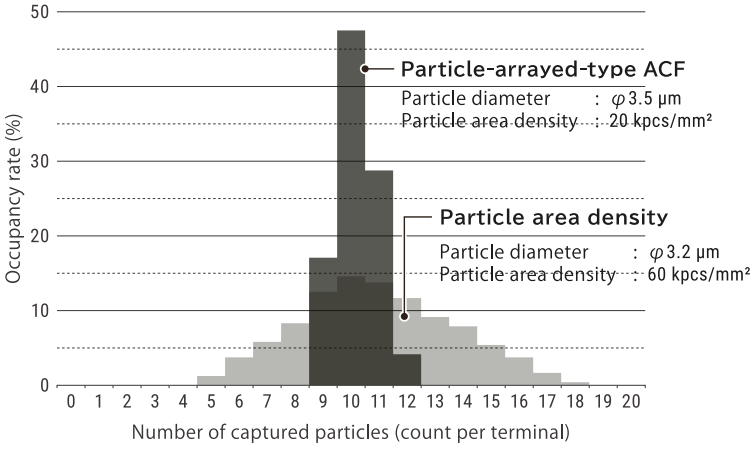


Comparison of connection structures (Example: COG)



* These figures show cross-sectional images of samples prepared in order to observe particles between terminals.

Capturing particles

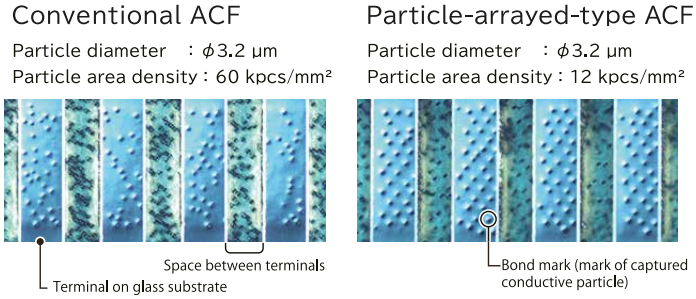


Verification conditions

Terminal area : 700 μm²
Bonding condition : 145 °C / 60 MPa / 5 sec.

State of captured particles (COG)

The particle-arrayed-type has a small particle area density (small number of particles), but it exhibits little variation in the number of captured particles per terminal, and the particles are uniformly dispersed on the terminal surfaces.



Product lineup

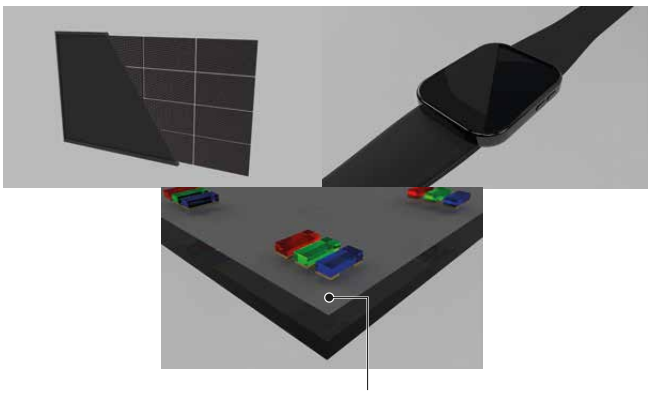
Product name		PAF300 Series	PAF400 Series	PAF700 Series
Type		LCD	OLED	LCD / OLED
Connection material		COG	COG/COP	FOG/FOP
		IC	IC	FPC
Minimum space [μm] *1		5	8	5
Minimum connection area [μm²] *2		400	720	1,000
Thickness [μm]		16	10	10
Particle density [pcs/mm²]		20,000	16,000	12,000
Conductive particle	Type	Ni plating on polymer particle	Ni plating on polymer particle	Ni plating on polymer particle
	Particle diameter [μmϕ]	3.2	3.0	3.2
	Particle with insulation coating	○	○	○
Main bonding conditions	humidity [°C]	130 – 160	190 – 230	160 – 180
	Time [sec]	5	5	5
	Pressure *3 [MPa]	40 – 80	60 – 90 *4	LCD: 3 – 6, OLED: 4 – 8

*1: Minimum space: The space between adjacent circuits
*2: Regarding σ-value control of the minimum connection area, contact us per product.
*3: Main bonding pressure: The pressure for COG was calculated from the total bump area. The pressures for FOG, FOB, and FOF processes were calculated from the bonding areas.
*4: The recommended pressure for COG. For the pressure for COP, contact us.

Example applications

Display equipment employing MicroLEDs (e.g., monitors and smartwatches), head-mounted displays, smart glasses, and electronic devices with flat panel displays (e.g., smartphones).

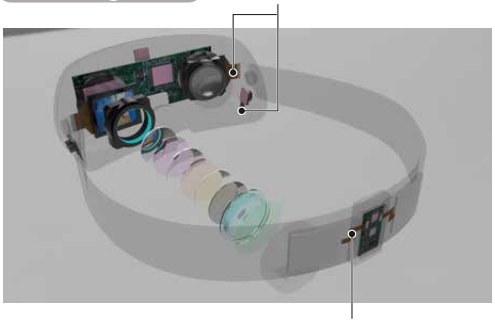
MicroLED display



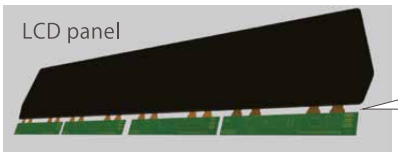
Particle-arrayed Anisotropic Conductive Film (ACF)

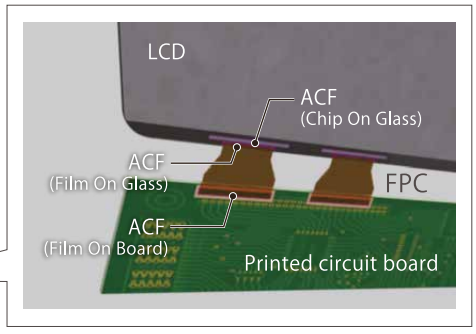
MicroLED smartwatches

AR / VR glasses



Instrument cluster





Dexerials Corporation

As of March 31, 2024

Corporate Profile

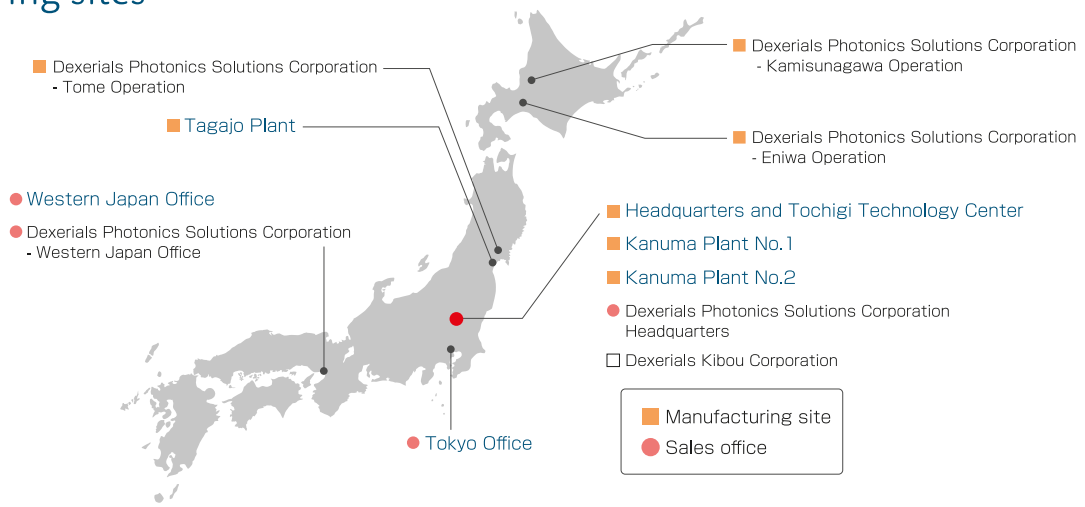
Establishment	June 20, 2012
Headquarters	1724 Shimotsuboyama, Shimotsuke-shi, Tochigi 323-0194, Japan
Representative Director and President	Yoshihisa Shinya
Capital stock	16.2 billion yen
Consolidated Employees	1,892
Major manufacturing sites (In Japan)	Tochigi Technology Center, Kanuma Plant, Tagajo Plant
Group companies (In Japan)	Dexerials Photonics Solutions Corporation Dexerials Kibou Corporation
Overseas group companies	Dexerials America Corporation Dexerials Europe B.V. Dexerials (Suzhou) Co., Ltd. Dexerials (Shanghai) Corporation Dexerials Taiwan Corporation Dexerials Korea Corporation Dexerials Singapore Pte. Ltd.

Major products

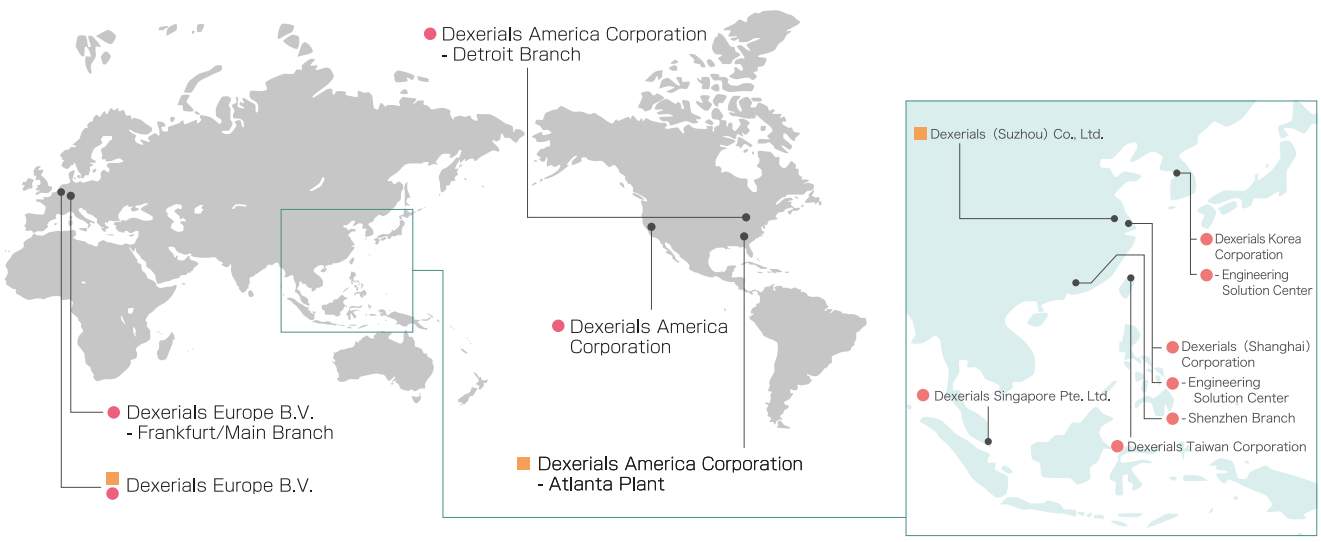
Anisotropic Conductive Film (ACF),
Optical elastic resin (SVR),
Anti-reflection film,
Surface mounted type fuse,
Industrial adhesive tapes,
UV curable resin for optical disks,
Sputtering targets,
Inorganic waveplate,
Inorganic polarizer,
Opto semiconductor elements,
Optical and opto sensors and-
Optical communication-use devices

Sales offices and manufacturing sites

Domestic Base



Overseas



Value Matters

Unprecedented innovation,
unprecedented value.

Dexerials Corporation TEL: 03-3538-1230 https://www.dexerials.jp/

The document was created in Oct 2024.