

High Performance Optical Components

**ZeonorFilm™**

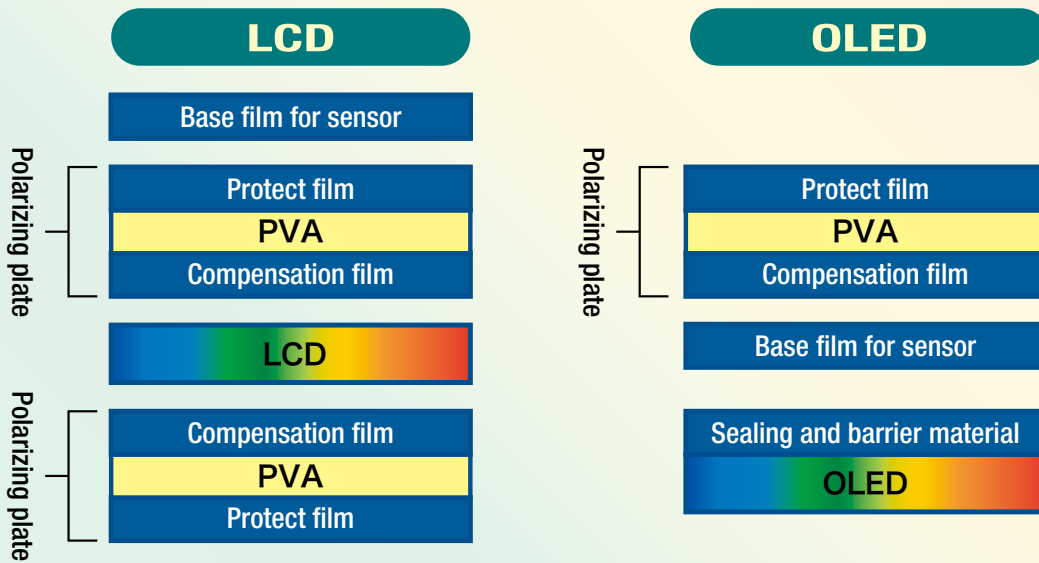
**ZEON CORPORATION**

# What is ZeonorFilm™?

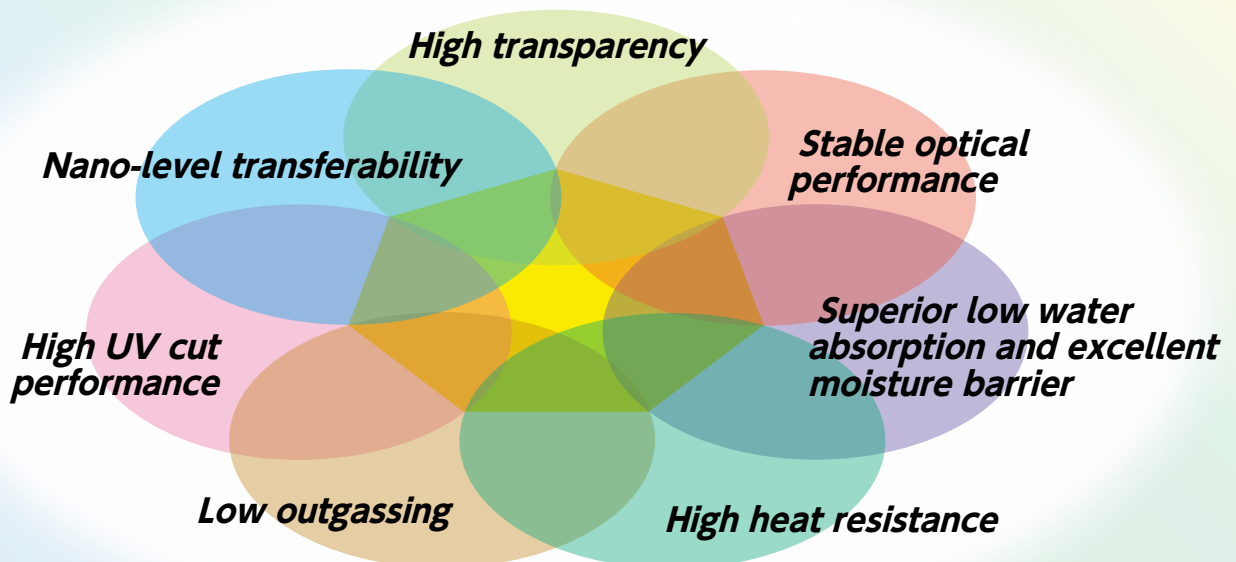
ZeonorFilm™ is the world first mass produced optical film with Zeon's melt extrusion technology.

With Zeon's proprietary deposition technologies(extrusion and stretching), Zeon offers ZeonorFilm™ as a superior optical material and retardation film to display and touch industries.

## Structure of a Flat Panel Display and Example of Applied Optical Films



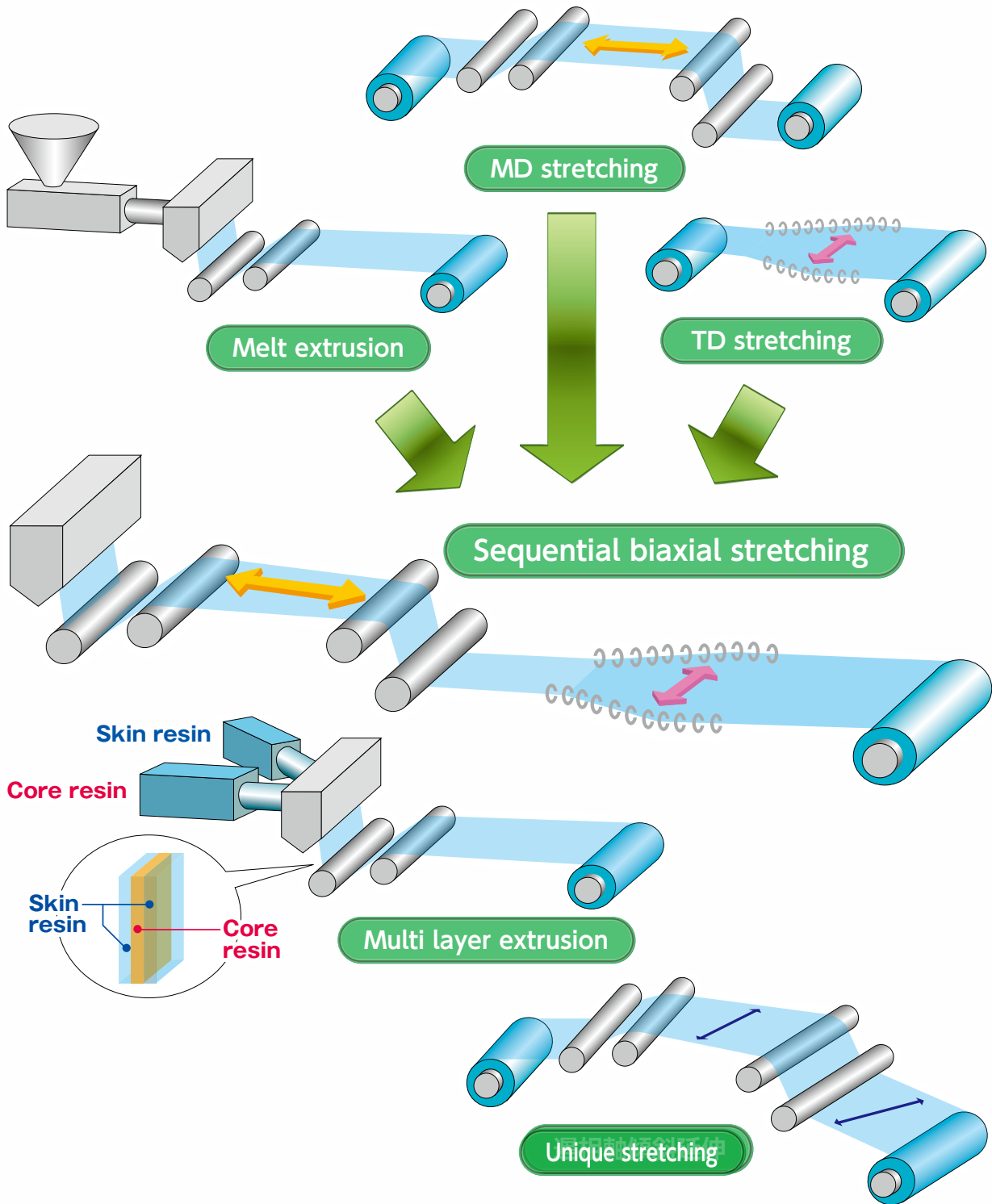
# Characteristics of ZeonorFilm™



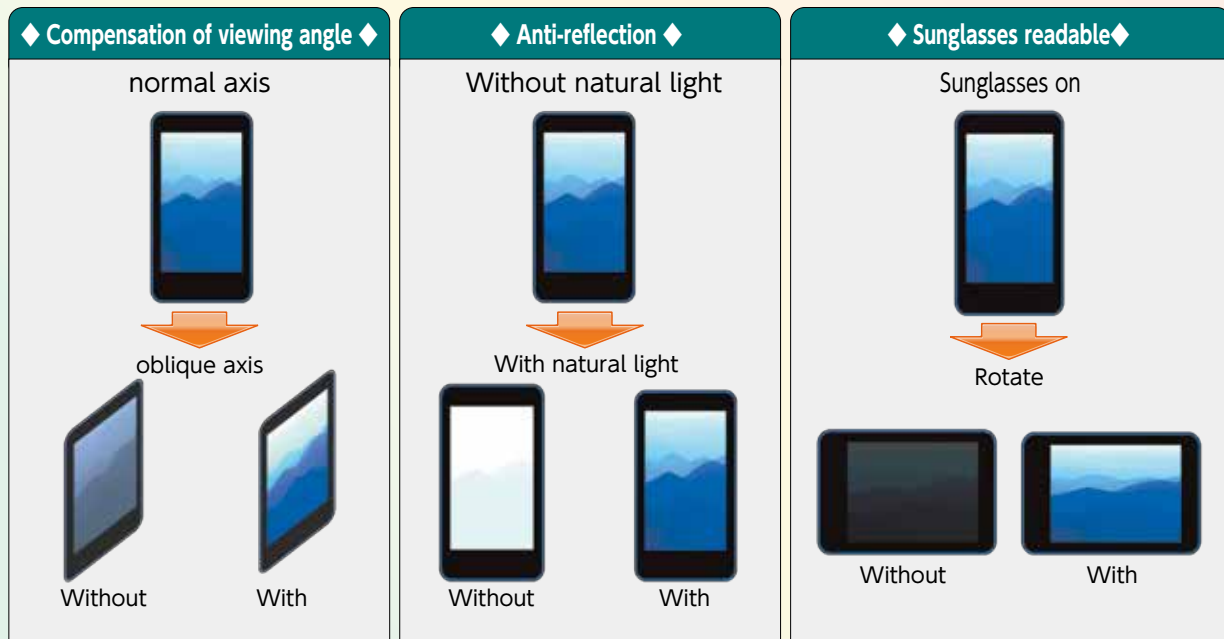


# Optical film processing technologies of Zeon

Zeon has developed a number of unique processing technologies, starting with the melt extrusion process



# Functions of Zeon's optical film



# ZeonorFilm™ Products and Applications

| Process            | Single layer | Multi layer | Applications                                      |
|--------------------|--------------|-------------|---|
| Melt extrusion     | ZF*          |             | Isotropic film, base film                         |
|                    |              | G+*         | UV cut  |
| MD stretching      | ZM*          |             | Wave plate (1/4 wave plate, 1/2 wave plate, etc.) |
| TD stretching      | ZT*          |             | Compensation - Mobile & tablet (IPS mode)         |
| Biaxial stretching | ZB*          |             | Compensation - LCD-TV (VA mode)                   |
| Unique stretching  | ZD*          |             | 1/4 wave plate                                    |
|                    |              | ZD+*        | UV cut and circular polarized light               |

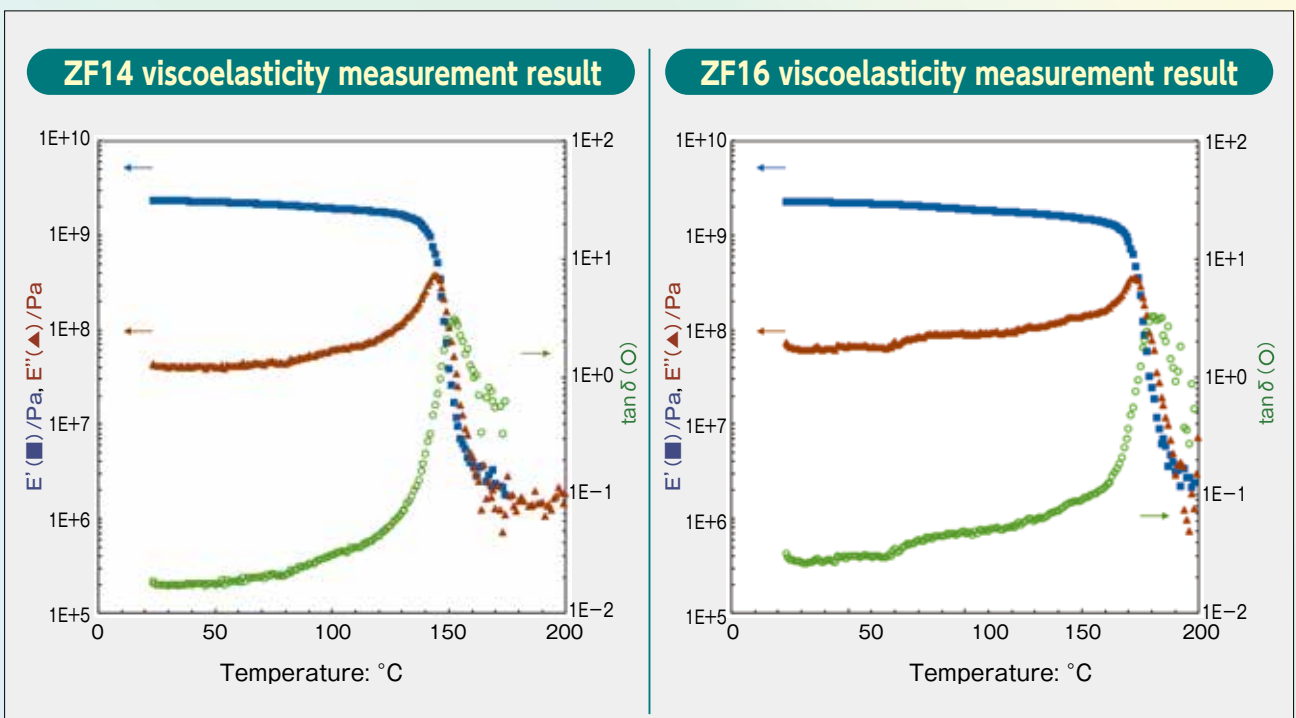
\*Series names and development codes



# Typical properties of ZeonorFilm™

| Item                          | Unit   | ZF14      | ZF16      | Test method   | Condition   |
|-------------------------------|--------|-----------|-----------|---------------|---|
| Glass transition temperature* | °C     | 140       | 170       | ASTM D4065    | 1Hz, 2°C/min                                      |
| Specific gravity              | —      | 1.03      | 1.04      | JIS Z8807     | 25°C  |
| Water absorption              | %      | under 1   | under 1   | ASTM D570     |   |
| Refractive index              | —      | 1.534     | 1.534     | -             | Spectroscopic ellipsometry reflected light 590 nm |
| Light transmittance           | %      | 91.5      | 91.5      | JIS K7361     |   |
| Haze                          | %      | under 0.1 | under 0.1 | JIS K7136     |   |
| Retardation                   | nm     | under 10  | under 6   | -             | AxoScan : 590nm                                   |
| Liner expansion coefficient   | ppm/°C | 70        | 70        | ASTM E831     | 25°C-100°C  |
| Tensile strength              | Mpa    | 70        | 80        | ASTM D412     | 10mm/min.   |
| Tensile elongation            | %      | 50        | 20        | ASTM D412     | 10mm/min.   |
| Pencil hardness               | —      | 3B        | 3B        | JIS K5600-5-4 |   |
| Dielectric constant           | —      | 2.4       | 2.4       | ASTM D150     | 1 MHz   |

\*Glass transition temperature was defined as the temperature at which the storage modulus ( $E'$ )



The logo for ZeonorFilm™ is displayed in a bold, blue, sans-serif font. The letters 'Z', 'e', 'o', 'n', 'o', 'r', 'F', 'i', 'l', 'm' are all in blue, with a trademark symbol (TM) to the upper right of the 'm'. The background behind the logo is a soft, out-of-focus rainbow gradient.The logo for ZEON is displayed in a bold, blue, sans-serif font. The letters 'Z', 'E', 'O', 'N' are all in blue. The background behind the logo is a soft, out-of-focus rainbow gradient.

## Contact Information

Please contact us for more information on ZeonorFilm™, including about its optical performance and applications.

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