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Professor Jae-Suk Lee and Dr. Chang-Lyoul Lee's research team develops high color purity photonic crystal film based on polymer particles containing perovskite that can be used as a light source for TV

- GIST (President Seung Hyeon Moon) – Professor Jae-Suk Lee of the School of Material Science and Engineering and Dr. Chang-Lyoul Lee of the Advanced Photonics Research Institute (APRI) have succeeded in developing high-precision photopolymer films that can be used as light sources for TVs by synthesizing polymers containing perovskite and manufacturing 3-D photovoltaic crystals.
- Hybrid perovskite is attracting attention as a next generation optoelectronic material that can be used for TV, mobile, etc., because it has high luminous efficiency and solution processability. However, perovskite has a large refractive index and is difficult to commercialize because of its low light extraction efficiency and is easily decomposed by water when compared with current commercialized organic light emitting diodes (OLED).
 - Three-dimensional photonic crystal is a structure in which spherical particles having a uniform size are regularly arranged and has been studied as an optical film for increasing light extraction efficiency in diodes. It has also been used in designing a

laser with a very narrow half width * by utilizing the resonance of light occurring in the photonic crystal.

* The half-width is the width at half the wavelength of a certain color. The closer the half width is, the higher the color purity, so that a color close to the natural color can be simulated.

- The researchers have fabricated a perovskite-containing photonic crystals whose polymer particle size is controlled by self-emulsion polymerization.
 - The luminescence of the perovskite contained the optical structure of the photonic crystal and the enhancement-canceling action, so that a color having a very narrow half width could be realized.
 - The polycrystalline structure is controlled to fabricate a polycrystalline photonic crystal, thereby widening the viewing angle of the photocrystalline containing perovskite to be utilized as a light extracting optical film. In addition, it was confirmed that the water stability of the perovskite encapsulated in the polymer particles was increased.
- Professor Jae-Suk Lee said, "Through this research, we increased the color purity of perovskite materials by utilizing a polycrystalline photonic crystal based on homogeneously synthesized polymer particles through self emulsion polymerization, and we were able to improve the moisture stability, which is the biggest problem of perovskite materials. We have built an important foundation for the development of next generation displays using perovskite photonic crystals with wide viewing angles."
- Dr. Chang-Lyoul Lee said, "In the future, research on optical structures that can improve the color purity and simulate natural colors of various luminescent materials are expected."
- This research, led by Professor Jae-Suk Lee (corresponding author) of the School of Material Science and Engineering and Dr. Chang-Lyoul

Lee (corresponding author) of APRI, was supported by the National Research Foundation of Korea and was recently published in *Materials Horizons*, a well-known academic journal in materials science.

