

Fluoromaterials attracting attention in 5G




TECHNICAL
REPORT

The advent of 5G is expected to greatly improve the convenience of our communications. Daikin's fluoromaterials and technologies are gaining attention as a way to realize and popularize the 5G concept of high-speed, high-capacity, low-latency, and simultaneous multi-connections.

1. What is 5G?

The 5th Generation Mobile Communication System (5G) is a communication technology that enables high-speed transmission of high-definition and large-capacity content, which has not been possible with the conventional 4G technology.

Fig.1 Features of 5G

eMBB Enhanced Mobile Broadband	URLLC Ultra-Reliable Low Latency Communication	mMTC Massive Machine-Type Communication
 x10	 1/10	 x10
Extensive service using VR and 3D	Enables autonomous driving and improves the comfort of using communication equipment in spaces crowded with people	Widespread use of the IoT and realization of remote medical care, smart cities, etc.

2. Communication in the millimeter-wave frequency band is a challenge in popularizing 5G

The 5G communications services are already available, but several challenges have been pointed out for their popularization. One of them is the high frequency range (millimeter-wave frequency band*) used in 5G, where the loss of radio waves is high.

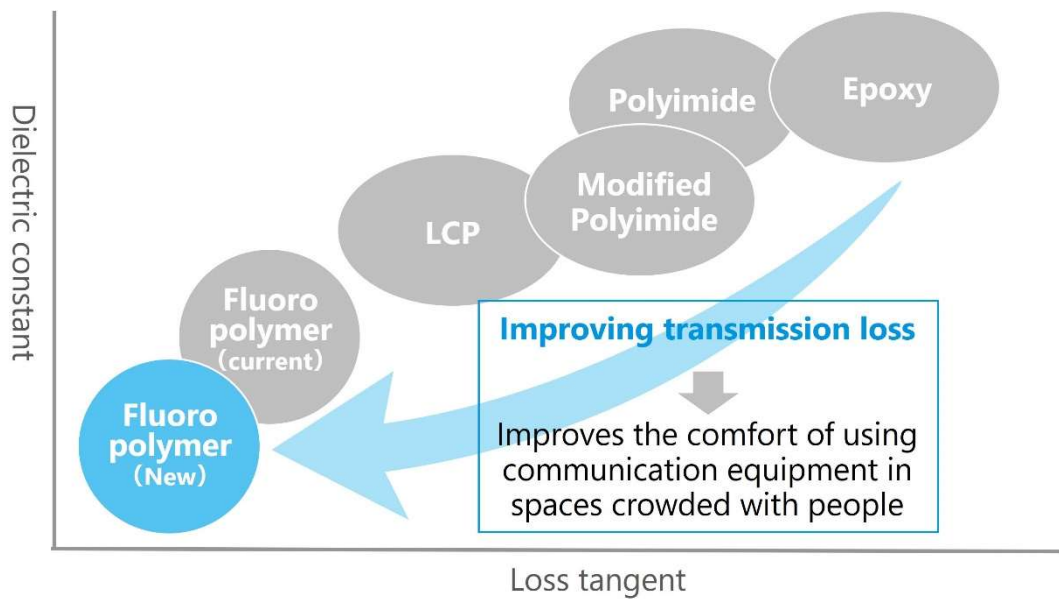
Specifically, transmission loss, in which a portion of the energy is lost, increases in transmission components such as printed circuit boards and communication cables. Daikin's fluoromaterials and technologies are gaining attention as materials that can contribute to the widespread use of 5G communications.

*The millimeter-wave frequency band refers to the millimeter-wave band of 28 GHz or more, as opposed to 800 MHz to 2.4 GHz currently in use.

3. Fluoromaterials are the key to popularizing 5G

Fluoropolymer is known as a material with a low dielectric constant and a small dielectric loss tangent ($\tan \delta$), which is an indicator for loss in dielectric materials. The small dielectric loss tangent also contributes to reducing transmission loss and improving electrical signal delay. Taking advantage of these excellent electrical properties, fluoropolymers are being explored as materials for printed circuit boards and cables used in smartphones, base station antennas, and data center routers, and switches.

Fig.2 Electrical properties of fluoromaterials



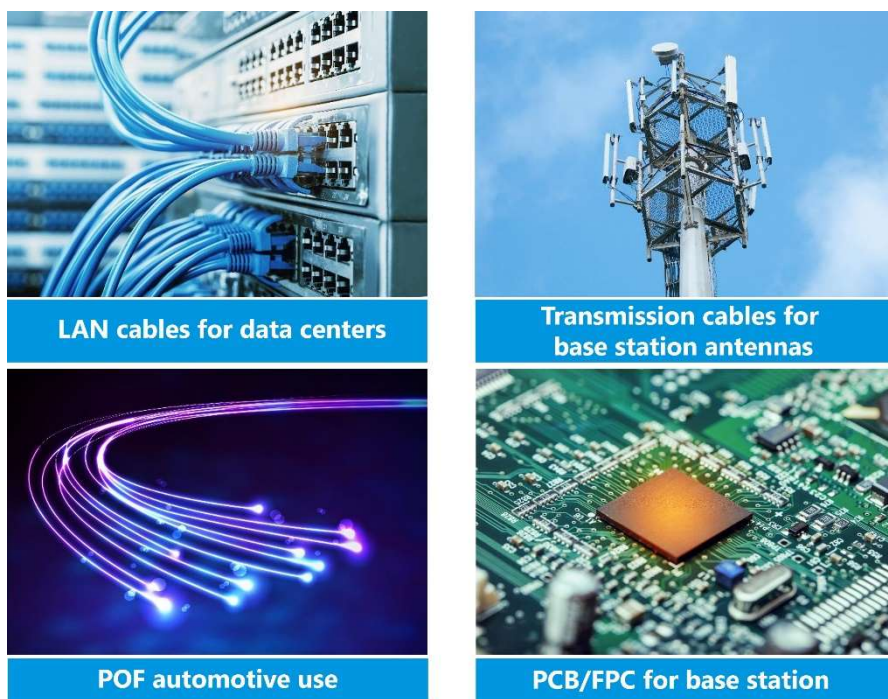
4. Characteristics of fluoropolymers other than electrical properties that are gaining attention

Fluoropolymer is excellent not only in electrical properties but also in functionalities such as flame retardancy, weatherability, and low refraction index.

For example, data centers that need a highly secure environment require flame-retardant materials that do not burn easily when a fire occurs. Fluoropolymer is used as a insulation material for LAN cables used in data centers, mainly in the North American market, because of its high flame retardancy.

Fluoropolymer also has weatherability that shows less deterioration even when exposed to rain and ultraviolet rays. Assuming the use in base station antennas, this material is less likely to deteriorate over time than other polymers. This long-lasting feature gives a side benefit of reducing the person-hours needed for maintenance and inspection at base stations.

In addition, taking advantage of its low refraction index, it is used as a cladding material for plastic optical fiber (POF) used in the proximity of automotive audio systems. Use of POF for conductors is expected to reduce weight and improve design flexibility.

Fig.3 Applications of fluoromaterials

5. From 5G to 6G - fluoromaterials that contribute to realization of high-speed communication

In the next-generation 6G communications, the use of optical wireless communications with a shorter wavelength than millimeter waves is also expected. Daikin continues to improve fluoropolymers in use, and is also working to develop fluoropolymers with a lower dielectric constant and loss tangent as well as materials with a lower refraction index to be used in optical communications.

Daikin, with its technology that created more than 2,000 fluorochemical products, is committed to contributing to the future of new 5G and 6G communications services and businesses.

For more information, visit our website.

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