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Nippon Electric Glass Co., Ltd.

## **Development of 5G-Suitable Materials for LTCC with the Industry's Lowest Loss Tangent** **— Reducing communication transmission loss to realize efficient communication —**

Nippon Electric Glass Co., Ltd. (Head Office: Otsu, Shiga, Japan, President: Motoharu Matsumoto) developed materials for LTCC<sup>\*1</sup> with a low loss tangent<sup>\*2</sup> suitable for components and devices used for 5G communication and expanded its product lineup.

5G has gained the spotlight as a next-generation communication technology that allows high-speed, large-capacity, low-delay communication and multiple simultaneous connection, highlighting the need to promptly construct its system. In 5G communication, for which high frequencies of 28 to 40GHz called millimeter waves are used, various LTCC substrates are used for components and devices that process signals (e.g., circuit boards, filters). In these components and devices, since signals are attenuated and communication quality deteriorates in proportion to frequency and loss tangent, in the case of high frequencies like millimeter waves, in particular, in order to achieve more efficient communication, it is necessary to reduce the attenuation of signals by using materials with a low loss tangent.

The company successfully developed and started selling three types of materials (low dielectric constant, high CTE, and high mechanical strength) for LTCC featuring a low loss tangent. For all three types, the loss tangent is two to four times lower than that of conventional materials, contributing to reduction of signal attenuation. These products are materials that have growing market demand due to the rapid progress of 5G communication. They are also effective in components for millimeter-wave radar and 60GHz band WiFi, which use higher frequencies. The features and advantages of each product are shown in the table below.

The company is manufacturing and selling special glass products for various electronic devices. With these products, the company will furtherly respond to new market needs and contribute to improve the performance of next-generation communication equipment.

<New products and their features>

Type		Low dielectric constant	High CTE	High mechanical strength	Conventional products	
Glass code		MLS-23	MLS-51	MLS-63	MLS-25ES	MLS-1000
Loss tangent	28GHz	<b>0.0016</b>	<b>0.0015</b>	<b>0.0014</b>	0.0027	0.0040
	40GHz	<b>0.0016</b>	<b>0.0015</b>	<b>0.0015</b>	0.0028	0.0047
Dielectric constant	28GHz	<b>3.8</b>	5.4	7.9	4.1	7.7
	40GHz	<b>3.8</b>	5.5	7.9	4.1	7.7
CTE (ppm/°C)		6.1	<b>9.7</b>	8.7	6.0	6.1
Bending strength (MPa)		130	160	<b>400</b>	150	274
Advantages		Contributing to reducing transmission loss and delay speed. Perfect for inductors and module boards.	Having a CTE close to resin substrates, improving reliability in joining	Having the industry's highest bending strength, achieving reduction of substrate thickness	—	—

\*1. LTCC: Low Temperature Co-fired Ceramics. This is a composite material of glass powder and ceramic powder, and can be fired at low temperatures of 1000°C or less. By co-firing this material and a silver conductor with high electric conductivity to create a multilayer structure, complex high-frequency components can be manufactured.

\*2. Loss tangent: a measure of energy when electrons in a dielectric are polarized. The smaller the loss tangent, the lower the conversion of electromagnetic energy into heat, and as a result attenuation of signals is reduced.

<New product>



<Application: green sheet>

