CTO Message

Going beyond “testing” with graphene

For Anritsu to exist in 2030 as a company that contributes to society through “testing”, we are working to acquire new technologies while expanding the business domain and developing new businesses. One of the new technologies we are focusing on is graphene. Graphene is a form of carbon that is familiar to us all, but it was only in the 21st century that a method for its production was established, and it is expected to be used in a wide range of fields in the future. However, there are still many parts of the mechanism of graphene that remain unexplained, and it is essential to elucidate them in order to expand the range of its utilization. Anritsu has been engaged in graphene research and development since April 2020, with the aim of utilizing graphene in the future.

About Graphene

Graphene is a single atom-thick sheet of carbon atoms bound together in a hexagonal honeycomb lattice. The tubular form is called a “carbon nanotube” and is used in fuel cells. The pencil lead we have used since childhood is made of layers of graphene called “graphite”. Soot, which is produced when a substance is burned, is another form of graphite. In fact, graphene bonded three-dimensionally turns into a diamond. It is a so-called “miracle material” very close to us with a wide range of uses.

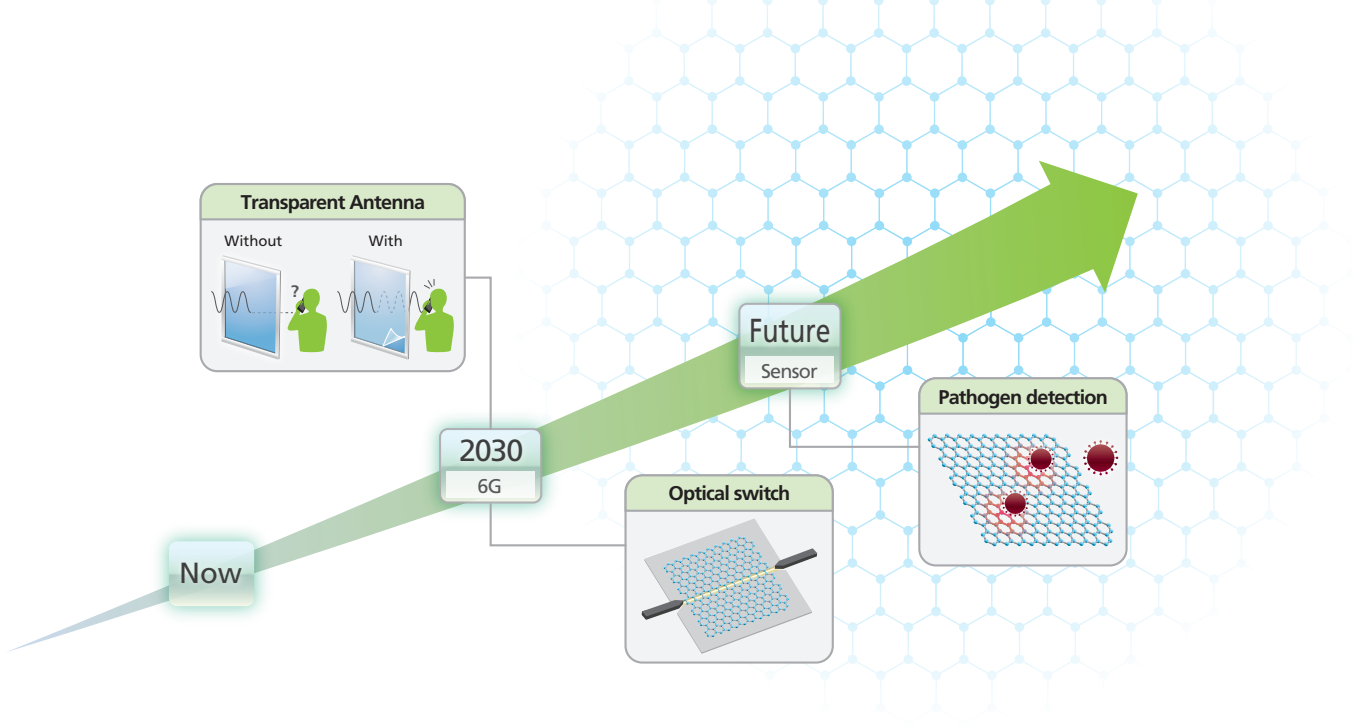
Graphene has long been the focus of academic attention, but progress on studying it has stalled due to difficulties in its procurement. Since its successful production in 2004, research on its application has progressed. The graphene production method discovered at that time is called the “Scotch tape method,” in which a piece of cellophane tape is used to repeatedly peel graphene flakes off of a lead pencil. This method is still used today. In 2010, Andre Geim and Konstantin Novoselov were awarded the Nobel Prize in Physics for their groundbreaking experiments regarding the two-dimensional material graphene.

Characteristics of Graphene

Graphene has a variety of excellent properties. Graphene is strong and flexible, conducts electricity more easily than metals, has high thermal conductivity, and is highly transparent due to its thinness. Let us focus on strength. Graphene has a honeycomb structure, which makes it elastic and shock-dispersive. Imagine a soccer goal. The net of a soccer goal has a honeycomb structure to disperse impact and prevent tearing. Graphene is 0.3nm thick. The thickness of a piece of copy paper is 0.1mm and the thickness of a hair is 0.05mm, so the thickness of graphene is approximately 1/100,000th of the thickness of a hair. Despite its near-zero thickness, graphene is said to be 200 times stronger than iron. If we could make a hammock with a single layer of graphene, a 4-kg housecat could be placed on it without tearing it.

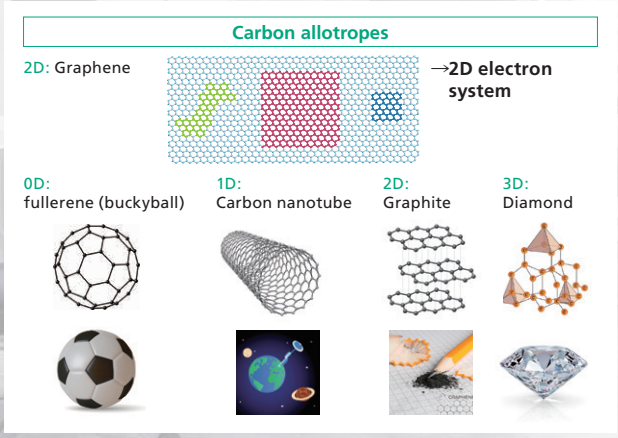
Hanako Noda

Executive Officer, CTO
General Manager of Advanced Research Laboratory



Expectations for Graphene Applications

Research and development is underway around the world for applications of graphene, which has a variety of excellent properties. One example of graphene application is transparent conductive film. Graphene's extremely thin, highly transparent, and conductive properties are expected to be applied to touch panels, solar cells, liquid crystal displays, and more. In addition, the film is also expected to be used in battery applications, taking advantage of its easy conductivity, high resistance to chemicals and other agents, and large surface area of carbon. Furthermore, they are expected to be used in transistors which amplify signals and act as on/off switches in smartphones and other electronic devices. The use of graphene is expected to enable the creation of smaller sized transistors, which means even faster speeds and lower power consumption. It has also been reported that transistors compatible with terahertz waves, which are expected to be used in 6G, are now being developed as a result of this research.



Anritsu Envisions the Future with Graphene

Because of its toughness and lightness, graphene is intended to contribute to the advancement of micro-electro-mechanical systems (MEMS), which are indispensable for devices such as mobile phones. In addition, since graphene has no covering, it can adsorb molecules by direct contact and change their properties significantly. For this reason, its application as a gas sensor is also being considered, and recently research is being conducted to apply graphene in the development of a COVID-19 test which outperforms PCR testing. Furthermore, by using its ability to absorb a wide range of light wavelengths from ultraviolet to terahertz, it can also be applied in optical sensors for terahertz waves, infrared light, and other electromagnetic waves. It is also expected to contribute to the advancement of components essential for communication, such as photodetectors and optical modulators. Also, being made into a transparent antenna sheet, as graphene can be an antenna for electromagnetic waves, it is also expected to help build our digital society of the future. Thus, graphene is a technology that is expected to be used in 6G, as well as contribute to the advancement of the sensing and the creation of a decarbonized society. In 2020, Anritsu began fundamental research on graphene NEMS (Nano-Electro Mechanical Systems), and in fiscal year 2021 we achieved a major breakthrough in establishing graphene microfabrication technology by processing graphene with atom-by-atom precision. This achievement was presented at the 9th International Symposium on Surface Science. We will continue to investigate the properties of graphene itself in collaboration with external parties. And we will continue our research and development on graphene to be used as the sensors and 6G devices in order for Anritsu to go "beyond testing".