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Professor Jong Seok Lee's research team discovers multiferroic van der Waals material with an atomic-layer thickness

▫ GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) Department of Physics and Photon Science Professor Jong Seok Lee Professor and Seoul National University Center for Quantum Materials Professor Je-Geun Park's research team discovered a multiferroic van der Waals material with an atomic-layer thickness in which ferroelectricity and anti-ferromagnetism occur simultaneously.

- The research team used second harmonic generation technology to verify that a multiferroic state exists in which ferroelectric and antiferromagnetic alignment coexist in the van der Waals material NiI_2 at a level of atomic-layer thickness.

▫ The van der Waals material is an important material system that can be used as an electronic device based on various physical properties, such as quantum conduction, ferroelectricity, and magnetism, as well as two-dimensional physical phenomena due to the weak bonding force between adjacent layers.

- One of the greatest advantages of the van der Waals material system is that multifunctional nanodevices can be realized by stacking various materials with various properties in atomic layer units.

  - Multiferrous materials have the property of simultaneously exhibiting ferroelectricity and antiferromagnetism in one material. Using this property, it becomes possible to develop it into a next-generation electronic device. Therefore, if multiferrousness can be realized in the van der Waals material system, especially at atomic layer thickness, it will be a great contribution to the realization of multifunctional nanodevices.

- The research team experimentally traced the change in the physical properties of the NiI_2 sample, a magnetic van der Waals material, according to the thickness control at the atomic layer level, and showed that multiferrousness exists at the original layer level in the material.

  - Using the physical exfoliation method, a thin NiI_2 specimen was prepared up to the thickness of a monoatomic layer, and it was confirmed that the ferroelectric phase transition was maintained up to the thickness of the diatomic layer by using the second harmonic detection method using a femtosecond laser. In particular, the magneto-electric effect as a multiferroic material was demonstrated through the ability to adjust the size of electric polarization through the application of a magnetic field.

- GIST Professor Jong Seok Lee said, "This research result is the first study to report multiferrousness in a thin van der Waals material system at the atomic layer level. In the future, it is expected that horizontal material technology will be dramatically expanded in the realization of multifunctional devices using van der Waals materials."

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