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Anisotropic polarization dependence of light scattering in black phosphorus JAE-UNG LEE, JUNGCHEOL KIM, Department of Physics, Sogang University, JINHWAN LEE, CHANGGU LEE[1], Department of Mechanical Engineering and Center for Human Interface Nano Technology (HINT), Sungkyunkwan University, HYEONSIK CHEONG, Department of Physics, Sogang University — We investigated anisotropic polarization dependence of light scattering in black phosphorus by optical microscopy and Raman spectroscopy. Due to a high carrier mobility ($\sim$ 300 V cm^2/s) and a high on/off ratio ($\sim 10^5$), black phosphorus is attracting interest as a promising candidate for a field effect transistor. Black phosphorus has an anisotropic crystal structure, which leads to directional dependence of the mobility and infrared light absorption. We prepared samples on SiO_2/Si substrates by mechanical exfoliation. We chose a few-hundred-nanometer thick sample with well-defined edges. By using a polarized optical microscope, we found that the optical contrast depends on the crystal direction. By comparing results with TEM measurements, we can determine the crystallographic orientation of the sample. We also performed polarized Raman measurements with several excitation energies. The intensity of each mode is largely dependent on the incident polarization direction. Furthermore, these polarization dependences vary with the excitation energy. From the polarization dependence of the Raman intensity one can determine the crystallographic orientation of the sample.

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