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Electrical Control of Microtubule Translocation on Graphene

EUNJI KIM, Department of Biophysics and Chemical Biology, Seoul National University, Seoul 151-747, Korea, DONG SHIN CHOI, Department of Nano Science and Engineering, Seoul National University, Seoul, 151-747 Korea, KYUNG-EUN BYUN, Department of Physics and Astronomy, Seoul National University, Seoul, 151-747, Korea, HEEJUN YANG, JINSEONG HEO, HYUN-JONG CHUNG, SUNAE SEO, Semiconductor Devices Lab, Samsung Advanced Institute of Tech., Giheung-Gu, Yongin-Si, Gyeonggi-Do 449-712, Korea, SEUNGHUN HONG, Department of Biophysics and Chemical Biology, Seoul National University, Seoul 151-747, Korea — Motor protein systems such as a kinesin-microtubule complex play an important role in intracellular cargo transport by directly converting a chemical energy into a mechanical work. For exploiting their high energy efficiency, there have been considerable efforts to integrate them with various nanostructures to build nanoscale biodevices such as an advanced nano-transportation system. Herein, we demonstrated a successful motility assay of microtubules on a kinesin-functionalized graphene electrode which has a good transparency and conductivity. By applying a voltage bias onto the graphene electrode, we could spatially control the translocation of the microtubules. Our result clearly shows that graphene can be used not only as a good substrate for a motor-protein motility assay but also as a key component for a nano-mechanical system based on biomotors.

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