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Gate-tuned spin to charge conversion in semiconducting single-walled carbon nanotubes EI SHIGEMATSU, HIROSHI NAGANO, Kyoto Univ, SERGEY DUSHENKO, Osaka Univ, YUICHIRO ANDO, Kyoto Univ, TETSUYA TSUDA, SUSUMU KUWABATA, Osaka Univ, TAISHI TAKENOBU, Waseda Univ, TAKESHI TANAKA, HIROMICHI KATAURA, AIST, TERUYA SHINJO, MASASHI SHIRAISHI, Kyoto Univ — Interconversion of spin and charge current is a hot topic in the molecular spintronics. It was achieved for the first time in a conducting conjugated polymer [1], and shortly followed by spin-charge conversion in graphene. However, control over carrier type has not been shown yet. In this study we focused on single-walled carbon nanotubes (SWNT). Spin injection into semiconductor from metal ferromagnet is challenging due to the presence of Schottky barrier and conductance mismatch problem. To bypass it, we used ionic liquid electric gate and ferrimagnetic insulator. We prepared SWNT layer on top of ferrimagnetic yttrium iron garnet substrate. Using spin pumping we successfully observed spin-charge conversion in metallic SWNT. As for a semiconducting SWNT, we applied a top gate using ionic liquid. The drain-source current vs. gate voltage dependence showed tuning of the Fermi level and changing of carrier type. Under gate voltage application we measured electromotive force induced by spin pumping. Detected voltage changed its sign together with carrier type. This is first evidence of spin-charge conversion in carbon nanotubes [2].
[1] K. Ando et al., Nature Mater. 12, 622 (2013).
[2] E. Shigematsu et al., submitted.

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