이차원 전자가스 내에서의 스핀전달

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One of the major difficulties in contemporary spintronics is the development of an efficient injection and detection of spin polarized current in semiconductors. In particular, purely electrical spin injection and detection are necessary to realize spin field effect transistors (spin-FET), of which a model device structure was proposed by Datta and Das in 1990[(1)]. The spin polarized current injected from a ferromagnetic electrode (source) transmits through a semiconductor channel to reach the other ferromagnetic electrode (drain) in a spin-FET. In this work, two-dimensional electron gas structure with InAs channel is used for spin transport channel and NiFe is used for spin injector and detector. In order to observe the spin diffusion length and relaxation tim nonlocal geometry is utilized. In this measurement geometry, two voltage terminals do not measure the section where charge current flows. Only the chemical potential sensitive to spin accumulation is measured by a ferromagnetic detector. From this research spin injection and relaxation in a ferromagnet-semiconductor system is systematically studied. We found that $l_s \approx 1.9$ mm, h $\approx 1.7\%$ at 50 K, $l_s \approx 1.5$ mm, h $\approx 1.7\%$ at 100 K, and $l_s \approx 1.3$ mm, h $\approx 1.4\%$ at 295 K, respectively. The injected spin polarization into InAs 2DEG and spin diffusion length show very weak dependence of temperature.

참고문헌

1. S. Datta and B. Das, Appl. Phys. Lett. **56**, 665 (1990).