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Direct Hall effect measurement on a single vanadium dioxide nanowire[1] ZHENG YANG, KETAKI SARKAR, University of Illinois at Chicago, YANG RESEARCH GROUP TEAM — Carrier concentration of the nanowires is one of the most important physical parameters, however, the current approach to estimate the carrier type and concentration in nanowires is an indirect measurement, in which nanowires are fabricated into three-terminal FETs and the carrier type and concentration of the nanowires are determined from FETs characteristics. This indirect measurement leads to inaccuracy comparing to a direct Hall effect measurement. Vanadium dioxide is an attractive material undergo a sharp metal-insulator phase transition showing a 3-5 orders of magnitude resistance change around 340K accompanying with a structural transition from monoclinic to tetragonal phase. [ref: Zheng Yang et al, Annual Review of Materials Research 41, 337 (2011)]. How the free carrier concentration in the vanadium dioxide changes with temperature, especially the temperature regime across phase transition, is an indispensable to be clearly understood towards this motivation. Here, we report our direct measurements of the carrier type, concentration, and mobility of a single oxide nanowire using Hall effect. The vanadium dioxide nanowires were grown using physical vapor transfer method. The nanowire Hall bar devices were fabricated using e-beam lithography and photolithography.

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