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Measurement of minority carrier diffusion length in individual silicon nanowires with an in-situ grown p-n junction A.D. MOHITE, D.E. PEREA, S. SINGH, S.A. DAYEH, S.T. PICRAUX, H. HTOON, LANL, CENTER FOR INTEGRATED NANOTECHNOLOGIES TEAM, CHEMISTRY DIVISION, LOS ALAMOS NATIONAL LABORATORY TEAM — We report a scanning photocurrent microscopy study across a p-n junction of individual in-situ doped Si nanowires (NWs). The measured photocurrent decreases exponentially as the laser spot is scanned away from the p-n junction in both directions. The photocurrent peak widens with increasing reverse bias, indicating the increase of depletion width. For a 40nm diameter NW, the fit of photocurrent decay to an exponential function gives minority carrier diffusion lengths of L_n=1.842 μm and L_p=1.45 μm for electrons and holes, respectively. Such relatively long minority carrier diffusion lengths are consistent with the low dopant incorporation we expected for our growth condition. This result further suggests that the diffusion length scales with doping concentration despite the impact of surface states of a 1D system. We will further discuss the dependence of the minority carrier diffusion length on diameter, doping concentrations, and back-gating.

Han Htoon
LANL

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