Using terahertz conductivity spectroscopy to assess III–V nanowires for future optoelectronic devices

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Accurately measuring the electronic properties of nanowires is a crucial step in the development of novel nanowire-based devices. Measuring these properties using traditional contact-based techniques is, however, difficult because forming electrical contacts to nanoscale structures is technically challenging and introduces measurement artifacts. To avoid these problems, non-contact probes of nanowire conductivity are highly desirable. As a non-contact method of assessing carrier transport and dynamics at room temperature, optical pump–terahertz probe (OPTP) spectroscopy is ideally suited to studies of nanowires [1]. In this presentation I will outline the principles of OPTP spectroscopy, and discuss its measurement of critical electronic properties, including *carrier lifetime*, *surface recombination velocity* and *carrier mobility*, of GaAs, InAs and InP nanowires [2, 3].

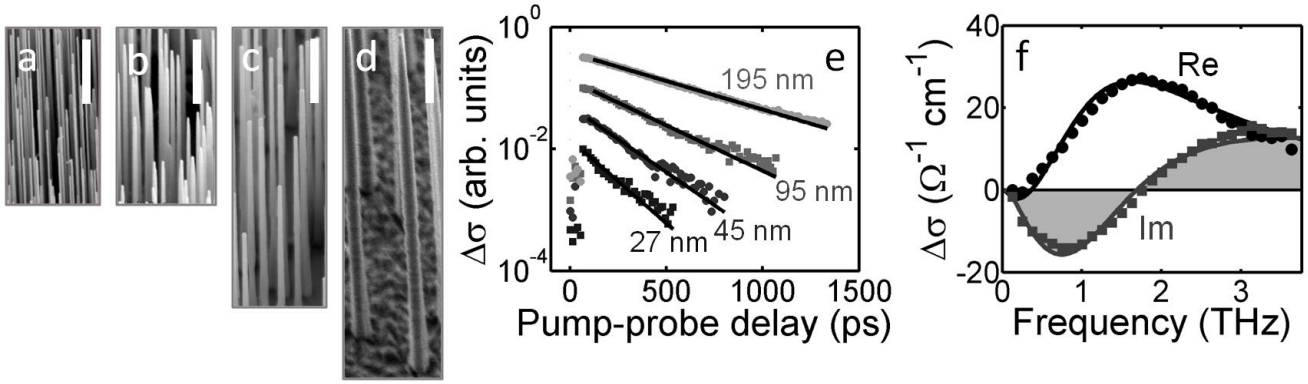

Figure 1: SEM images of zinc-blende InAs nanowires of (a) 27, (b) 45, (c) 95 and (d) 195 nm average diameter, (b) photoconductivity decays of these nanowires, and (c) photoconductivity spectrum of the 45 nm diameter nanowires revealing a high electron mobility of 6000 $cm^2V^{-1}s^{-1}$.

[1] H. J. Joyce, Q. Gao, H. H. Tan, C. Jagadish, Y. Kim, J. Zou, L. M. Smith, H. E. Jackson, J. M. Yarrison-Rice, P. Parkinson, and M. B. Johnston, *Prog. Quantum Electron.*, **35**, 23–75 (2011).
[2] H. J. Joyce, J. Wong-Leung, C.-K. Yong, C. J. Docherty, S. Paiman, Q. Gao, H. H. Tan, C. Jagadish, J. Lloyd-Hughes, L. M. Herz, and M. B. Johnston, *Nano Lett*., 12: 5325–5330 (2012).
[3] H. J. Joyce, C. J. Docherty, Q. Gao, H. H. Tan, C. Jagadish, J. Lloyd-Hughes, L. M. Herz, and M. B. Johnston, *Nanotechnology*, 24: 214006 (2013).