Details of the transient THz photoconductivity experiment

To measure the photoconductivity of GaAs nanowires on a picosecond timescale, an optical-pump terahertz-probe spectroscopy system was employed (similar to that described in Reference [3]). This technique provides a non-contact ultrafast probe of the photoconductivity of a sample with sub-picosecond resolution. Two sets of terahertz generation and electro-optic sampling crystals were used for this experiment. For the photoconductivity lifetime measurements, the terahertz probe was generated using optical rectification in 2 mm ZnTe and sampled in 1 mm ZnTe crystal. This provided a probe with electric field of approximately 0.6 kV/cm and usable bandwidth of 0.1–2.3 THz. For the spectral conductivity measurements, a 200 μm GaSe crystal was used for terahertz generation, and a 200 μm <110> on 6 mm <111> ZnTe chip was used for sampling. This provided a smaller signal, but a usable bandwidth of 0.2 – 3.5 THz.

The excitation pulse was generated in a Titanium:Sapphire regenerative laser amplifierwith a repetition rate of 1 kHz, and had a centre wavelength of 810 nm, a duration of ~50fs, and a fluence varying between 4 and 300 $\mu J/cm^2$/pulse. We directly measure the photoinduced change in terahertz transmission through the nanowires using a double lock-in detection method, which for the comparable case of a uniformly excited thin film is proportional to the photoinduced conductivity.[9] The largest photoinduced change in terahertz transmission measured was $\Delta T/T=4\times10^{-3}$.

[3] P Parkinson, J Lloyd-Hughes, Q Gao, HH Tan, C Jagadish, MB Johnston, LM Herz, *Transient terahertz conductivity of GaAs nanowires*, Nano Lett. **2007**, 7, 2162-2165.
[9] P Kuzel, F Kadlec, H Nemec, *Propagation of terahertz pulses in photoexcited media: Analytical theory for layered systems*, J. Chem. Phys. **2007**, 127, 11.