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Significant Variation of Surface Quality in VLS grown Silicon Nanowires Observed by Pump Probe Microscopy EMMA CATING, CHRISTOPHER PINION, CALEB CHRISTIE, ERIKA VAN GOETHEM, JAMES CAHOON, JOHN PAPANIKOLAS, Univ of NC - Chapel Hill — Free carrier recombination in nanowires (NWs) is impacted by surface quality (i.e. surface trap density). In NWs, surface quality is described by the surface recombination velocity (SRV) which relates NW diameter (d) with carrier lifetime (τ) according to SRV = $d/4\tau$. It is often assumed that all NWs in an ensemble grown at same time have similar surface properties, and so SRV is usually found through either ensemble averaged techniques, or device-based measurements which only examine a small number (less than 10) of NWs. Neither technique provides a means of examining the distribution of SRVs between wires, so the question remains: how much variation in SRV is there between NWs grown at the same time? We determine SRV in nearly 300 individual silicon NWs using pump-probe microscopy to measure the lifetime of the free carrier population at a specific location in the NW, and SEM to measure NW diameter at the same position. In this way we determine SRV on a point-by-point basis for each individual wire. We find that SRV, and therefore surface quality, varies along an individual NW by as much as a factor of 10, and by up to two orders of magnitude between NWs grown at the same time.

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