

Plasmon Propagation and Fan-Out in Silver Nanowires

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The observation that coupled electron-phonon modes (plasmon polaritons) can propagate optical frequencies at sub-wavelength dimensions has led to the notion that photonic circuits and waveguides can be realized at the nanoscale. However, the realization of simple optical components that propagate these signals have yet to be demonstrated. Here we present simple approaches for both coupling to propagating plasmon modes and their observation in simply realized metallic nanowire assemblies. Far-field reemission of light is observed from the ends and other regions of high radius of curvature in the nanowire. Plasmons are also observed to both couple and re-emit at junctions between nanowires, demonstrating plasmon fan-out at the nanoscale. Propagation lengths of several microns are observed for nanowires less than 100 nm in diameter.

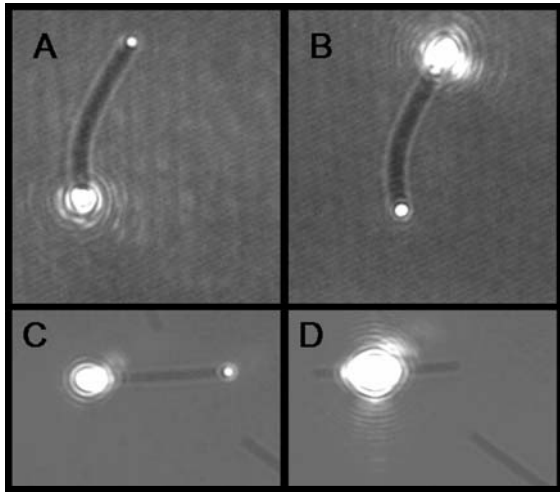


FIG. 1. Micrographs showing the spatial sensitivity of launching plasmons. A) Nanowire with excitation at the end. B) Same nanowire with excited from opposite end.. C) Nanowire excited at left D) Same nanowire with laser positioned over body of nanowire. Notice that the plasmon is not excited in this geometry.

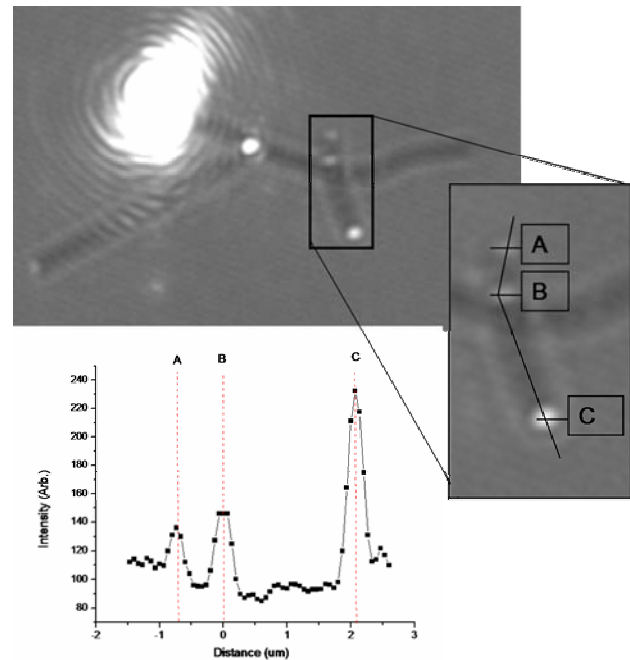


FIG 2. Group of overlaying nanowires that illustrates inter-wire plasmon coupling. The excitation at the far left nanowire end produces reemission at both the nanowire junctions, and reemission from the coupled nanowires as well. The inset shows an intensity line cut showing the reemission intensity profile along wire.