

229b One-Dimensional Nanostructures as Subwavelength Optical Elements for Photonics Integration
[Invited]

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The manipulation of optical energy in structures smaller than the wavelength of light is key to the development of integrated photonic devices for computing, communications and sensing. Wide band gap semiconductor nanostructures with near-cylindrical geometry and large dielectric constants exhibit two-dimensional ultraviolet and visible photonic confinement (i.e. waveguiding). Combined with optical gain, the waveguiding behavior facilitates highly directional lasing at room temperature in controlled-growth nanowires with suitable resonant feedback. The nanowire optical emission has been studied in detail using high-resolution optical microscopy. This concept of using well-cleaved nanowires as natural optical cavities may be extendable to many other different semiconductor systems. We have further explored the properties and functions of individual ultralong crystalline oxide nanoribbons that act as subwavelength optical waveguides and assess their applicability as nanoscale photonic elements. The length, flexibility and strength of these structures enable their manipulation on surfaces, including the optical linking of nanoribbon waveguides and other nanowire elements to form networks and device components. We have demonstrated the assembly of ribbon waveguides with nanowire light sources and detectors as a first step toward building nanowire photonic circuitry.