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Optical microtube ring resonators formed by rolled-up strained semiconductor bilayers TOBIAS KIPP, CHRISTIAN STRELOW, HOLGER WELSCH, CHRISTIAN HEYN, DETLEF HEITMANN, Institute of Applied Physics, University of Hamburg, Germany — Starting from an epitaxially grown InGaAs/GaAs bilayer and using optical lithography and wet-etching processes, we utilize the self-rolling mechanism of strained bilayers to fabricate self-supporting microtubes with diameters of about 5 μm and wall thicknesses of only 100 - 200 nm. We demonstrate these structure to act as optical ring resonators by measuring the photoluminescence of an optically active material, either quantum wells or self-assembled quantum dots, which is embedded into the tubes' walls. We find spectra of sharp modes arising from constructive interference of light running circularly around the micotube's axis inside its wall. The mode structure is in very good agreement with the result of a theoretical modeling of the microtube as a thin dielectric waveguide forming a closed ring. These novel microtube ring resonators, in which the optically active material is intrinsically located close to the optical field maximum, are good candidates for both, new optoelectronic devices and cavity quantum electrodynamic experiments. We gratefully acknowledge financial support of the Deutsche Forschungsgemeinschaft via the SFB 508 "Quantum Materials" and the Graduiertenkolleg 1286 "Functional Metal-Semiconductor Hybrid Systems."

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