

Silicon-chip-based optical resonators with Q factor > 100 million

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A novel processing method has been applied to create optical micro-resonators having Q factors as high as 500 million on silicon wafers. These devices open up many new applications for lab-on-a-chip experimental work. After describing the processing and passive optical properties of these devices, the consequences of resonant energy buildup in a microscale, ultra-high-Q system will be described. Demonstrations of micro Raman and micro OPO lasers based on these cavity structures will be reviewed. Finally, radiation confined within a vessel exerts pressure upon its walls. If the vessel is a high-Q micro-cavity, then a weak power level, coupled to the cavity, can exert a substantial, resonantly-enhanced pressure on the internal micro-cavity walls. Such a pressure will deform the cavity structure and change the resonant condition. This effect has been theorized to produce a parametric oscillation in the mechanical modes of the optical resonator. The first observation of this effect will be described.