Cavity-confined Slow Light in Photonic Crystal Slab

F. Bordas[1], L. Ferrier[1], M. J. Steel[2], C. Seassal[1], E. Drouard[1], X. Letartre[1], and A. Rahmani[3]
[1]INL, UMR CNRS 5270, Ecole Centrale de Lyon, 69130 Ecully, France
[2]RSoft Design Group, Inc., NSW 2008; and CUDOS University of Sydney, NSW 2006, Australia
[3]CUDOS and CLA, Department of Physics, Macquarie University, North Ryde, NSW 2109, Australia

In this communication, we present a design strategy for photonic crystal slab devices that blends the compactness of defect cavities with the high density of state of slow-light modes. We show how a core-cladding geometry can be used to confine slow-light modes, discuss the influence of different geometrical parameters on the confinement efficiency for modes located both below and above the light line, and explain the behaviour of the confinement with a very simple model. As this approach leads to quality factors up to 10^7, with low modal volumes, we discuss the numerous possible applications, and present some of them in details. We also report room temperature lasing around 1.5μm, with a threshold of a few hundred μW of peak pump power, using a single layer of InAs/InP quantum dots as gain medium and confined slow-light Bloch modes.