Introduction to the Feature Section on Photonic Crystal Structures and Applications

THIS FEATURE Section on photonic crystal structures and applications was inspired by the sudden growth in this topical area that has occured over the past few years. We believe this Feature marks a milestone in photonic crystal research and presents a snapshot of a remarkably dynamic field. Many more groups have entered the field and are understanding rapidly how to apply their advances in fabricating photonic crystal structures to real device structures. As a result, these groups are able to look much more seriously towards applications with the projection that commercially worthy devices and systems should appear within two to three years. Progress is further accelerated by the fact that extended numerical modeling of experimental structures is now commonplace, thereby reducing cycle times and increasing understanding and success rates.

The emphasis of this feature is clearly on two-dimensional (2-D) structures and the functionality they can provide, whereas three-dimensional (3-D) systems, while having made great progress as well, are still at the stage of addressing fabrication issues and achieving defect-free structures. Recent progress in the 3-D area [1], however, indicates that these issues are beginning to be addressed and that functional devices can also be achieved.

What functionalities are being developed? Many groups are discussing waveguides in photonic crystal lattices, mainly with a view towards integrated optics applications in telecommunications, where issues such as losses and useful bandwidth are primary concerns. Coupled cavity waveguides and their interesting dispersive properties capture the imagination, as well as coupled waveguides and cavities which can be seen as the first "microcircuits" since they feature more than one functional element. The problem of coupling light into such microcircuits is also being addressed, e.g., via a grating coupler with respectable efficiency that is proposed and demonstrated. The attainment of ever higher Q factors in planar photonic crystals is another fascinating topic that can be useful for cavity QED experiments or for microscopic lasers. These and other timely and interesting developments are described in this volume. It is our hope that the present collection of material will provide a useful reference and stimulate further progress in this very exciting field.

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REFERENCES

[1] Y.A. Vlasov, X. Z. Bo, J. C. Sturm, and D. J. Norris, "On-chip natural assembly of silicon photonic bandbap crystals," *Nature*, vol. 414, no. 6861, pp. 289–293, Nov. 2001.

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