Deep Submicron Two Dimensional Photonic Crystal Fabrication

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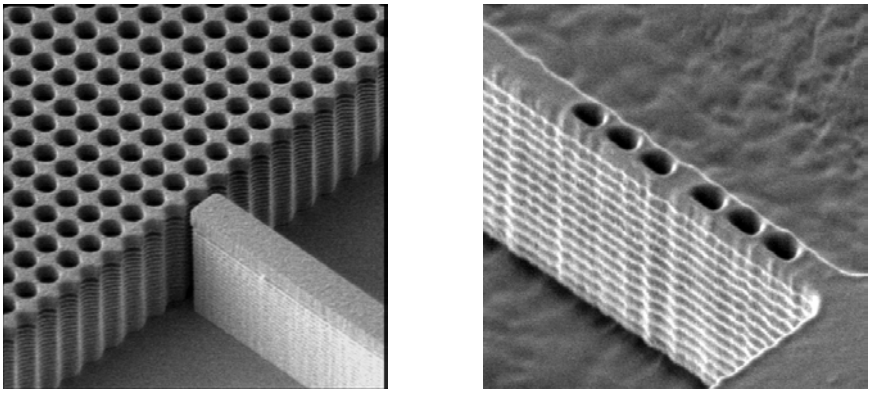
We report the fabrication of deep submicron size two dimensional (2D) photonic crystal (PhC) using synthesized processing techniques of deep UV lithography, time-multiplexed reactive ion etching (TMRIE) and focus ion beam etching.

In this study, 200mm silicon on insulator wafers were used to create mixed density of holes and waveguide pattern needed to form 2D PhC structures. Through use of a KrF based scanner, large array patterns of PhC hole-lattice was transferred together with fine lines of waveguides. In the pattern transfer step following hard mask definition, ultra wide grooves were patterned, aligned to the deep submicron size devices. Following deep etching of more than 50 um by TMRIE, PhC structures are then revealed for device etching. Such design of fabrication process method allows realization of disparate pattern dimensions and also etching depths. Through avoidance of etch loading effect in etching, notching of devices at interface of device silicon and buried oxide layer was avoided. At the same time, a wide process window of lithography for high repeatability patterning was made possible by introduction of singular focused ion beam (FIB) etch used to obtained individual holes on narrow monorail structures in the final step of the process following buried oxide release. The structures of dense holes are shown in Fig. 1a while the released monorail device (with FIB etched PhC holes) is shown in Fig. 1b.



(a) (b)

Figure 1 (a) Structure of dense hole together with fine waveguide; (b) Released monorail structure with FIB etched PhC holes.