



Fig. 6. (a) Schematic of the system (b) Transmission spectrum of photonic-crystal slab with and without particles above (c) $F_x c/\phi$ on particle 1 for 3 different positions of particle 2 (d) $F_y c/\phi$ on particle 1 for 3 different positions of particle 2. The legend indicates the position of particle 2 in (b), (c), and (d).

4. Conclusions

We predict that optical forces above photonic crystal slabs will lead to a variety of complex, stably trapped crystal patterns. Changing the wavelength or polarization of the incident light may be used to reconfigure the patterns.

In the system studied here, the particles do not significantly affect the transmission spectrum [Fig. 6(b)]. We have checked that even if the particles are placed inside the holes in the slab or on the slab surface, the shift in the resonance is a small fraction of the resonance width ($\sim 15\%$ or less). For larger particles, particles of higher index, and/or higher Q slab resonances, particle trapping may begin to shift the resonance position. This opens up the possibility for intriguing phenomena such as self-induced or bistable trapping, effects which have previously been studied for particle trapping near photonic cavities [28]. This is an interesting direction for further research.

We expect the approach of light-assisted self-assembly, described here, to be of broad utility for fabrication of complex photonic materials, sensors, and filters. It is intriguing to consider whether metamaterials based on metal nanoclusters [29], for example, could be assembled in the manner we describe, using the optical response of the nanoclusters to tune or adjust assembly.

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