Application of Liquid Crystals for tunable Photonic Crystals

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In this project tunable Photonic Crystals were built by filling a nematic liquid crystal in porous structures. Colloidal crystals composed of PMMA, inverted colloidal crystals of tin sulfide and two and three dimensional Photonic Crystals of macroporous Silicon were used.
By changing the temperature, a tuning of the band gap was successfully observed in all four systems. In colloidal crystals it was possible to observe a change of the band gap by applying external electric fields. Because of a higher filling fraction of the liquid crystal in the inverted structure a much bigger tunability was achieved than in the PMMA-structures.
Macroporous silicon is very interesting for potential applications. In two- and tree dimensional structures a shift of the liquid crystal band and a shift of a resonant mode in a three dimensional structure were observed. The experimental results are in good agreement with theoretical calculations.
NMR experiments with α-deuterated 5CB in two- and three dimensional Photonic Crystals of macroporous silicon showed a uniform alignment of the director **n** parallel to the pore axis. In addition the orientation of the director field was changed to an escaped radial orientation distribution inside the pores by coating the pore surfaces with DMOAP.