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Characterization of an All-Optical Device Based on Organic Materials

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Abstract: We present numerical and first experimental results for an all-optical switching device. The device consists of a periodically modulated nonlinear waveguide, where so-called gap solitons stabilize the switching process. The fabrication of Bragg gratings in different polymeric films, e.g. poly(phenylene vinylene), polydiacetylene or polystyrene by excimer laser photoablation was tested. In preparation of further experiments numerical calculations were performed to characterize the device under realistic conditions, including position dependent index modulations and absorption losses. In further time-dependent simulations the transition from the reflecting to the transparent state was investigated in detail. As a main result, the threshold intensity turns out to be of the order of 100 MW/cm^2 for a realistic device layout and well-known materials, even in the presence of absorption losses. Furthermore, with this information an optimized, nonuniform Bragg reflector was designed and numerically characterized, considering the typical optical properties of monocrystalline polydiacetylene.

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