2D Polymer Lens on the Bloch Surface Waves (BSWs) Based Novel Platform

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The motivation of this work is to develop a novel planar platform based on Bloch Surface Waves (BSWs) and to manipulate the BSWs propagation with two-dimensional (2D) dielectric patterns. It may provide universe utilizations for the 2D integrated optics combining sensing functionalities.

A new dielectric multiplayer is designed and fabricated as a planar platform to sustain Bloch Surface Waves (BSWs) in two dimensions. A measured field intensity enhancement of about 154 is achieved at the surface of the multilayer. Compare with the multilayer used in the past [1], the field enhancement of this structure is ten times stronger.

A schematic of the concept of the 2D polymer plano-convex lens on such a platform is illustrated in Fig.1. (a): the 2D dielectric structure performs as a modification of the BSW effective index. And the BSWs excitation is performed in the Kretschmann configuration shown in Fig.1. (b).

The first fundamental investigation of the light focusing through a 2D plano-convex lens (appended to a waveguide) is performed with the SNOM. The near-field amplitude distribution is illustrated in Fig1. (c). the bending structure of the first interface can be clearly seen from the field distribution when light cross through the lens. Its curvature corresponds to the topography in Fig 1. (d). its corresponding 2D model is built and simulated with FDTD in Fig 1. (e). Principally, the diffraction dominates the behavior of the light since its Fresnel Number (NF) is small. The impactions of the relative parameters are discussed in understanding the principle of the 2D convex lens.

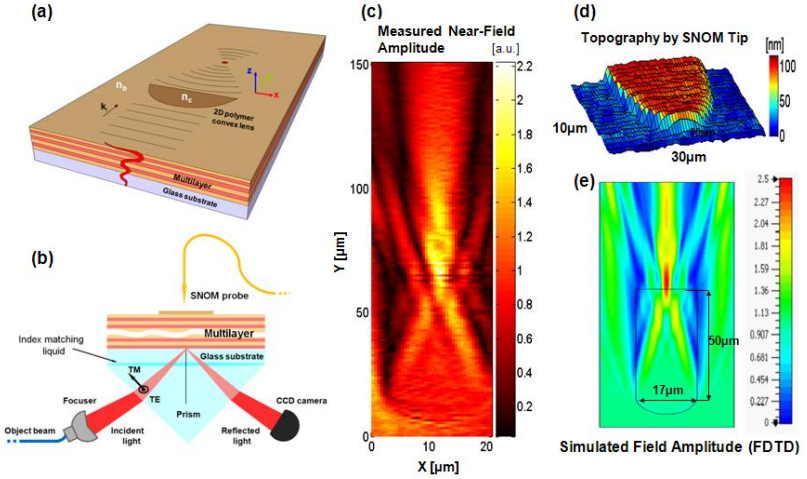

Fig. 1: (a) Schematic of the concept of the 2D plano-convex lens. The platform which sustains the BSWs consists in alternation of high- and low-indices dielectric layers. The filed amplitude distribution of the mode is shown at the cross-section of the multilayer: it is confined at the surface of the multilayer. An ultra thin convex lens made of AZ1518 is coated on the top of the platform. The reflective index of the BSWs on the bare multilayer and the coated layer and are represented as n_b and n_c respectively. (b) BSWs excitation is performed in the Kretschmann configuration using a BK7-glass prism. (c) Measured near-field amplitude showing light propagation through 2D plano-convex lens and gets focused; (d) the topography of the 100nm thin plano-convex lens; (e) correspondence FDTD simulation excluding the loss. Position of the 2D plano-convex lens and the attached waveguide is marked by the closed solid lines. The lens radius is R=8.5µm. the waveguide is of width 2R=17 µm and of length L=50µm.

[1] T. Sfez, E. Descrovi, L. Yu, M. Quaglio, L. Dominici, W. Nakagawa, F. Michelotti, F. Giorgis, H.P. Herzig, 2010. App. Phys. Lett. 96, 151101.