**Lead Inventor:** Serge Luryi, Ph.D., Distinguished Professor, Department of Electrical Engineering

**Title:** Photonic Waveguide Device for Modal Control

**Background:** The Photonic Band Gap (PBG) of a material corresponds to the energy and wavelength range for which the material neither absorbs light nor allows for light propagation. By inducing defects that form periodic structures it becomes possible to guide the flow of light through the PBG material in a manner similar to that of directing electron flow through doped regions of semiconductors. Essential features of previously developed PBG devices are that (1) a strictly periodic structure with well established repeated pitch between the openings or pores exists and (2) a rigid relationship between the radiation wavelength and pitch pattern or period of the structure should exist. Additionally, in prior art PBG devices, the wavelength has been required to be substantially equal to the pitch pattern of the periodic structure thereby limiting its utilization to a very narrow range of the radiation wavelength spectrum.

From a technological viewpoint, widespread commercial utilization of PBG devices has been quite difficult due to the above requirements / performance limitations.

**Technology Description:** The novel technology developed by Dr. Serge Luryi, Distinguished Professor, Department of Electrical & Computer Engineering, utilizes uniaxially patterned dielectric layers having an optical anisotropy that can be dynamically controlled. Performance properties are not dependant upon the geometrical rigidity of the structure (the long-range order of the pores or their diameter), making this invention significantly different from the prior art PBG devices. In addition the crystal structure makes use of long wave radiation, e.g. far-infrared, and does not require geometric rigidity. The invention is able to operate at wavelengths far greater than the pitch pattern (distance between adjacent pores).

**Applications:** One particularly important embodiment is the case when the core material is a semiconductor with optical gain. Another preferred embodiment involves the anisotropic control of the uniaxially patterned dielectric or semiconducting layers by optical pumping.

**Advantages:** The property of the device does not depend on the rigidity of the structure (i.e., the long range order of the holes or pores or their diameter). It also does not depend on the precise position of the inclusions or pores within the structure. Furthermore, the present invention utilizes wave frequency which is selected and used with the broad range origin.

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