TUNABLE BRAGG GAP IN A PERIODICALLY CORRUGATED WAVEGUIDE

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The principal physical phenomenon in wave propagation caused by periodicity is Bragg reflection. It results in the opening of the forbidden gap in the spectrum of the periodic structure. The Bragg reflection occurs both in the case of unbounded periodic medium as well as in a case of a bounded periodic structure like a periodic waveguide.

We investigated experimentally the microwave transmission properties of a hollow rectangular metallic waveguide, having lower and upper walls with the identical sinusoidal profile $y(x) = \xi cos(qx)$ and smooth side walls. Where ξ and *a* are an amplitude and a period of the corrugations equal correspondingly to 0.415 cm and 3.15 cm. Thickness and width of the waveguide were 5.4 cm and 6 cm. The upper periodic plate could slide with respect to the lower forming the phase shift $\triangle$ x between the plates.

It was predicted theoretically that the Bragg gap (and accordingly transmission coefficient) varied from zero to a maximum value upon a shift of one periodic plate with respect to another in accordance with formula (V.A.Pogrebnyak, *Opt.communications* **232**, 201-207, 2004)

$$\delta\omega = \left[\frac{2\sqrt{2}\xi}{3d}(1-\cos(q\triangle x))^{1/2}\right]\omega_{cutoff}. \quad (1)$$

In this paper, we are reporting on experimental observation of this phenomenon in the rectangular periodically corrugated waveguide.

A standard microwave setup with the HP8510 network analyzer was used for measuring of the transmission characteristics of the periodic waveguide at a frequency range 6-18 GHz. We investigated propagation of the TE wave along the x-axis and having the polarization vector parallel to grooves of the corrugation (the z-axis). The 1.36 GHz band gap in vicinity of the cutoff frequency of the 3rd mode has been observed when a shift between plates equals *a*/2. The gap closed when the shift between the plates vanished.

Thus transmission through the waveguide could be tuned from the maximum value down to 30 dB upon a shift of one periodic plate with respect to another on the half period of the corrugation.

The tuning mechanism can be used in different microwave, optoelectronic, and photonic applications.