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# Enlargement of the omnidirectional photonic band gap by one-dimensional plasma-dielectric photonic crystals with fractal structure

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**Abstract** In this paper, an omnidirectional photonic band gap (OBG) which originates from Bragg gap compared to zero-$\overline{n}$ gap or single negative (negative permittivity or negative permeability) gap, realized by one-dimensional plasma-dielectric photonic crystals with fractal structure (Thue–Mores aperiodic structure), which is composed of plasma and one kind of homogeneous, isotropic dielectric is theoretically studied by the transfer matrix method in detail. Such OBG is insensitive to the incident angle and the polarization of electromagnetic wave. From the numerical results, the bandwidth and central frequency of OBG can be notably enlarged by tuning the thickness of plasma and dielectric layers but cease to change with increasing the Thue–Mores order. The OBG also can be manipulated by the plasma density. Moreover, the plasma collision frequency has no effect on the bandwidth of OBG.

**Keywords** Plasma photonic crystals · Omnidirectional photonic band gap · Transfer matrix method · Fractal sequence

## 1 Introduction

Photonic crystals (PCs) are the periodical dielectric medium in one-, two-, and three-dimensional structures. Since pioneering work by Yablonovitch (1987) and John (1987), the PCs have been under intense research in theory and experiment, and it can produce the magic frequency regions named photonic band gaps (PBGs) where the propagation of electromagnetic wave (EM wave) is forbidden. Such property is similar to the electronic band gaps

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