Bragg Fresnel lens using Ag/ Al multilayer zone plate and Ge crystal

Masaki Koike and Isao H. Suzuki
Electrotechnical Laboratory 1-1-4, Umezono, Tsukuba-shi, Ibaraki, 305 Japan
E-mail: e8714@etlrips.etl.go.jp Phone: +81-298-58-5671 Fax: +81-298-58-5673

A new type of Bragg Fresnel lens (BFL) has been developed using a multilayer zone plate(MLZP) and a monochromator crystal[1,2]. In the present study, Ag and Al have been chosen as the materials for opaque and transparent layers, respectively. About 300 layers of Ag and Al were alternately deposited on a plane substrate according to Fresnel's formula using a helicon plasma(HP) sputtering technique, in which Ar gas pressure was less than 1 mTorr, which is one order lower than in conventional magnetron sputtering[3]. The multilayered plane was sliced vertically and glued onto Ge(422) crystal, and thinned to about 15 microns. By combining the dispersive characteristics of the crystal and the focusing capability of the MLZP, a new type of BFL has been developed. The device has several advantages as described in the following. (1)The device is completely free from chromatic aberrations. (2)The width of zones (layer thickness) is easily controlled by the HP sputtering technique and the outermost zone width of less than 10 nm, which determines focused spot size, can be fabricated. (3)The monochromator crystal works as a steady support for the MLZP.

[1]M.Koike et al, Tech.Dig.Pacific Rim Conf.Lasers & Electro-Optics(1995)106.
[2]M.Koike et al, Bull.Electrotech.Lab.59(1995)527.
[3]M.Koike et al, Rev.Sci.Instrum.66(1995)2141.