Study of the third order nonlinear optical properties of Zn1−xMgxSe and Cd1−xMgxSe crystals

Titre	Study of the third order nonlinear optical properties of Zn1−xMgxSe and Cd1−xMgxSe crystals
Type de publication	Article de revue
Auteur	Derkowska-Zielinska, Beata [1], Firszt, F. [2], Sahraoui, Bouchta [3], Marasek, A. [4], Kujawa, M. [5]
Type	Article scientifique dans une revue à comité de lecture
Année	2008
Langue	Anglais
Date	2008/03/01
Numéro	1
Pagination	8 - 11
Volume	16
Titre de la revue	Opto-Electronics Review
ISSN	1230-3402 / 1896-3757
Mots-clés	AIIBVI solid solutions [6], Applied Optics, Optoelectronics, Optical Devices [7], CdMgSe [8], DFWM [9], Materials Science [10], nanotechnology [11], Optical and Electronic Materials [12], optical nonlinearity [13], third order nonlinear optical susceptibility [14], ZnMgSe [15]
Résumé en anglais	Third order nonlinear optical susceptibilities χ<3> of ternary Zn1−xMgxSe and Cd1−xMgxSe crystals have been measured using standard degenerate four-wave mixing (DFWM) method at 532 nm. The nonlinear transmission technique has been applied to check if our crystals exhibit two-photon absorption. The studied Zn1−xMgxSe and Cd1−xMgxSe solid solutions were grown from the melt by the modified high-pressure Bridgman method. For both crystals the energy gap increases with increasing Mg content. In the case of Zn1−xMgxSe, it was found that the value of third order nonlinear optical susceptibility χ<3> decreases with increasing Mg content. An explanation of this behaviour results from the dependence of optical nonlinearities on the energy band gap Eg of the studied crystals. In the case of Cd1txMgxSe with low content of Mg, no response was observed for the studied wavelength since the energy gap in such crystals is smaller than the photon energy of the used laser radiation. It was also found that the value of third order nonlinear optical susceptibility χ<3> for Cd0.70Mg0.30Se is higher than for Zn0.67Mg0.33Se. This behaviour can be understood if one take into consideration that the free carrier concentration in Cd1−xMgxSe samples is about four orders of magnitude higher than that in Zn1txMgxSe ones with comparable Mg content respectively. It is commonly known that when the electric conductivity increases, the values of nonlinear optical properties increase. From the performed measurements one can conclude that the incorporation of Mg as constituent into ZnSe and CdSe crystals leads to a change of the third order nonlinear optical susceptibilities.

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DOI	10.2478/s11772-007-0029-1 [17]
Lien vers le document	http://dx.doi.org/10.2478/s11772-007-0029-1 [17]

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