本期目录 | 下期目录 | 过刊浏览 | 高级检索　　　　　　　[打印本页]　[关闭]

**论文**

### ZnO纳米柱无序介质中泵浦面积对局域模发射的影响

游巧琴[a], 李炳祥[a], 杨欢[a], 胡达波[a], 雷园[a], 王月明[a], 谢应茂[a,b]

a. 赣南师范学院 物理与电子信息学院,江西 赣州 341000;
b. 赣南师范学院 光电子材料与技术研究所,江西 赣州 341000

**摘要**:

基于ZnO纳米柱制备及发光实验,建立了ZnO纳米柱的位置和大小都是无序的二维介质结构模型.通过构建增益模型,用时域有限差分法数值模拟了无序介质中频谱特性以及ZnO增益频谱范围内的某一个共振峰对应的波源在无序介质中的光场分布情况,发现了局域模的存在.分四种情况讨论了此局域模的受激辐射与泵浦面积的关系:改变泵浦功率,从左到右依次增加两层ZnO纳米柱泵浦和单独泵浦一个局域区域;泵浦功率一定时,增加泵浦局域区域和非局域区域中ZnO纳米柱个数.结果表明:存在一个临界泵浦功率,当泵浦功率小于临界泵浦功率时,无论泵浦面积多大都不能激发局域模;当泵浦功率大于临界泵浦功率时,对于不同的泵浦功率,局域模被激发所需的临界泵浦面积不同;随着泵浦功率的增加,当泵浦面积一定时,光场相对强度呈递增趋势,当泵浦功率超过临界功率时,光场相对强度急剧上升.

**关键词**: 无序介质　局域模　泵浦面积　受激辐射

### Effect of Pump Area on Lasing Modes in Two Dimensional ZnO Nanorods Random Media

**YOU Qiao-qin[a], LI Bing-xiang[a], YANG Huan[a], HU Da-bo[a], LEI Yuan[a], WANG Yue-ming[a], XIE Ying-mao[a,b]**

a. School of Physics and Electronic Information, Gannan Normal University, Ganzhou, Jiangxi 341000, China;
b. Institute of Optoelectronic Materials and Technology, Gannan Normal University, Ganzhou, Jiangxi 341000, China

**Abstract**:

Based on the growth and photoluminescences experiment of Zinc Oxide (ZnO) nanorods, the structrue model of two-dimensional random media, in which the location and radius of ZnO nanorods are all disordered, was constructed. Using ZnO gain model, the spectrum characteristics and spatial distribution of optical field at some resonant peak in ZnO nanorods random media were simulated numerically by means of the finite difference time domain method, and the localized mode was found. The effect of pump area on stimulated radiation of the local mode in ZnO nanorods random media was studied from four aspects: changing the pump intensity, increasing the pump size every two columns from left to right, only pumping a zone of localized mode, and increasing the excitation area (the number of the ZnO nanorods) in localized area and nonlocal area respectively when the pump intensity is fixed. The results show: there exists a critical pump power; when the pump intensity is smaller than pump intensity at the lasing threshold, no localized mode can be excited with the size of the pump area; when the pump power reaches above the critical pump power, in the case of different pump powers, localized modes can be excited with different critical pump sizes; when the power size is fixed, the relative light intensity increases with the increasing of the pump intensity and the relative light intensity increases rapidly when the pump intensity exceeds the lasing threshold.

**Keywords**: Random media　Localized mode　Pump sizes　Stimulated emission

**作者简介**:

---

**参考文献**:

[1] LETOKHOV V S.Generation of light a scattering medium with negative resonance absorption[J]. *Soviet Physics JETP*, 1968, 26(8): 835-840.

[2] SERVICE R F. Will UV lasers beat blues[J].*Science*,1997, 276(5314): 895-897.

[3] ZHANG Guo-bin, SHI Chao-shu, HAN Zheng-fu, *et al.* Photolumi-nescence properties of ZnO films deposited on Si substrates[J]. *Journal of Luminescence*, 2001, 22(2): 157-159.

[4] YANG J K, BORISKINA S V, NOH H, *et al.* Demonstration of laser action in a pseudorandom medium[J].*Applied Physics Letters*, 2010, 97(22): 223101.

[5] CAO H, ZHAO Y G, ONG H C, *et al.* Ultraviolet lasing in resonators formed by scattering in semiconductor polycrystalline films[J]. *Applied Physics Letters*, 1998, 73(25): 3656-3658.

[6] CAO H, XU J Y, ZHANG D Z, *et al.* Spatial confinement of laser light in active random media[J]. *Physical Review Letters*, 2000, 84(24): 5584-5587.

[7] CAO H, ZHAO Y G, ONG H C, *et al.* Far-field characteristics of random lasers[J]. *Physical Review B*, 1999, 59(23): 15107-15111.

[8] CAO H, ZHAO Y G, HO S T, *et al.* Random laser action in semi-conductor power[J]. *Physical Review Letters*, 1999, 82(11): 2278-2281.

[9] CAO H, LING Y, XU J Y, *et al.* Photon statistics of lasers with resonant feed back[J]. *Physical Review Letters*, 2001, 86(20): 4524-4527. [ZK]

[10] CAO H, XU J Y, SEELING E W, *et al.* Microlaser made of disorder media[J]. *Applied Physics Letters*, 2000, 76(21): 2997-2999.

[11] CAO H. Random lasers-development, features and applications[J]. *Optics and Photonics News*, 2005, 16(1): 24-29.

[12] LIU X, WU X H, CAO H, *et al.* Growth mechanism and properties of ZnO nanorods synthesized by plasma-enhanced chemical vapor

**扩展功能**

本文信息

- Supporting info
- PDF(1691KB)
- HTML
- 参考文献

服务与反馈

- 把本文推荐给朋友
- 加入我的书架
- 加入引用管理器
- 引用本文
- Email Alert
- 文章反馈
- 浏览反馈信息

本文关键词相关文章

- 无序介质
- 局域模
- 泵浦面积
- 受激辐射

本文作者相关文章

- 游巧琴
- 李炳祥
- 杨欢
- 胡达波
- 雷园
- 王月明
- 谢应茂

deposition [J].*Journal of Applied Physics*, 2004, 95(6): 3141-3147. cross<sup>ref</sup>

[13] YU S F, CLEMENT Yuen, LAU S P, *et al*. Random laser action in ZnO nanorod arrays embedded in ZnO epilayers[J]. *Applied Physics Letters*, 2004, 84(17): 3241-3243. cross<sup>ref</sup>

[14] SONG Q H, CAO H, Improving optical confinement in nanostructures via external mode coupling[J]. *Physical Review Letters*, 2010, 105(5): 053902.

[15] CAO H. Review on latest developments in random lasers with coherent feedback[J]. *Journal of Physics A: Mathematical and General*, 2005, 38(49): 10497-10535. cross<sup>ref</sup>

[16] XIE Ying-mao, LIU Zheng-dong. Effect of pump area on lasing in active random media[J].*Chinese Physics Letters*,2005, 22(11): 2827-2830. cross<sup>ref</sup>

**本刊中的类似文章**

1. 王慧琴 刘正东 冷新丽.光在二维无序介质中的动态传播过程[J]. 光子学报, 2009,38(3): 709-712

2. 孙志红.由光子晶体局域模对称关系分析其简并性[J]. 光子学报, 2005,34(3): 468-472

3. 廖庆洪 刘正东 尤素萍 曹昌祺.微腔中单量子点的受激辐射行为[J]. 光子学报, 2008,37(5): 883-886

4. 王冰 刘正东 王慧琴.无序介质中不同模式的激光辐射与散射体密度的关系[J]. 光子学报, 2009,38(4): 975-978

5. 谢应茂 刘正东.活性无序介质中泵浦功率对局域模发射的影响[J]. 光子学报, 2009,38(3): 551-555

---

**文章评论** (请注意:本站实行文责自负, 请不要发表与学术无关的内容!评论内容不代表本站观点.)

| | | | |
|---|---|---|---|
| 反馈人 | | 邮箱地址 | |
| 反馈标题 | | 验证码 | 5500 |
| 反馈内容 | | | |

提交

---