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OPTICAL PROPERTIES OF A NEW LEAD FLUOROBORATE GLASS DOPED WITH YTTERBIUM

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A new laser glass of lead fluoroborate doped with ytterbium produced at the Laboratory of Glasses and Datation at FATEC-SP is presented in this work. Ytterbium is of interest in lasers for the next generation of nuclear fusion and also as sensitizer of energy transfer for infrared lasers. There are only two manifolds in the Yb^{3+} energy level scheme; so the lack of intermediate levels and the large separation between the excited state and the ground state manifolds reduce the non-radiative decay. In this work the emission cross- section and the fluorescence lifetime (measured at IPEN) are determined in lead fluoroborate glasses with different concentrations of ytterbium. The concentration was measured by the X ray Fluorescent Spectrometry with wavelength dispersion and also used to calculate the absorption cross-section. The emission cross-section is determined from absorption and emission measurements at room temperature. The sample with 1.153×10^{20}ions/cm^3 has a good combination of properties: fluorescence lifetime of 0.81ms (for Yb:tellurite laser glass it is of 0.9ms), emission band at 1022nm, with emission cross- section of 1.07×10^{-20}cm^2, comparable to Yb:PNK, a phosphate laser glass, for which this value is of 1.08×10^{-20}cm^2; the fluorescence effective linewidth is of 60nm and the product of emission cross-section and fluorescence lifetime is of 0.86. We remark that a high value of this product is generally desirable for the gain media to be compatible with InGaAs or GaAlAs diode pump sources and to have higher laser efficiency. These results make this glass a promising laser material to be used in short pulse generation under diode pumping. This work is supported by FAPESP, FATEC-SP and IPEN.

ÓPTICA (Lasers e Instrumentação Óptica) – 17/05/2001

[Painel - 14:00]

INSTRUMENTO ELETRO-ÓPTICO PARA MEDIDAS AUTOMATIZADAS DA ACOMODAÇÃO DO OLHO HUMANO (IN VIVO) DURANTE MEDIDAS REFRATIVAS

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Ao olhar para o infinito, diz-se que o olho normal está em repouso e ao olhar para um objeto mais próximo, o músculo ciliar está contraído, dando ao cristalino uma forma mais esférica, processo esse que chamamos de acomodação visual. Nos seres humanos, a habilidade do olho variar o foco é permitida pela mudança no formato do cristalino; não há mudança na curvatura da córnea ou no tamanho do globo ocular. O mecanismo= acomodativo envolve o músculo ciliar, as zônulas, a cápsula e a flexibilidade do cristalino. Os auto-refratores só possuem precisão nas medições dos erros refrativos oculares, se o olho do paciente, a ser analisado, estiver acomodado. Este tem sido um grande problema para as análises feitas por instrumentos refrativos automáticos. Não pode ocorrer flutuação durante o processo de aquisição dos erros refrativos. Essas flutuações ocorrem devido ao processo de acomodação, que se deve ao fato do cristalino tentar sempre manter a imagem nítida na retina, variando seu poder dióptrico conforme a influência de alguns fatores. Esses fatores podem ser: a distância do objeto visto, a atenção e a fadiga no momento, iluminação do local, detalhe da imagem, embaçamento da imagem formada na retina e até mesmo alguns problemas psicológicos do paciente. A ocorrência de flutuações na acomodação durante o processo auto-refrativo pode induzir erros nas medidas de correção esférica e cilíndrica, não obtendo assim, a confiabilidade necessária nos resultados obtidos pelo processo. O intuito desta apresentação é explanar o desenvolvimento de um instrumento eletro-óptico para medidas automatizadas da acomodação do olho (in vivo) durante as medidas refrativas, podendo ser utilizado em qualquer equipamento que utilize o processo auto-refrativo.

[Painel - 14:00]

GLASSES OF HEAVY METAL OXIDE DOPED WITH YTTERBIUM

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A new ytterbium doped heavy metal oxide glass (Yb:BPG), produced at the Laboratory of Glasses and

Datation at FATEC-SP is presented. This host of heavy metal oxide, discovered by W.H.Dumbaugh in 1985, has applications in optoeletronic circuits because of the characteristics as transmission in the far infrared (up to 9μm), high refractive index and nonlinear optical behavior. Since 1995, the literature has presented the use of rare-earth (Er^{3+}, Tm^{3+}, Dy^{3+}, Pr^{3+}) in this host for laser applications and we reported the use of Nd^{3+} last year. Laser cooling was recently achieved in solids for the first time in a ytterbium doped heavy metal fluoride glass (Yb:ZBLANPb). This work deals with optical and physical properties of PbO-Bi_2O_3-Ga_2O_3 glass doped with ytterbium, not yet reported in the literature. The sample was melted at 1000degC for approximately one hour and annealed at 300degC for 3 hours. The high refractive index, of 2.52, was measured by means of the apparent depth method; the knoop hardness, of 321kg/mm^2 and density, of 4.63g/m^3 were also measured. The concentration of Yb^{3+} was determined using the X Ray Fluorescent Spectrometry with wavelength dispersion and used to determine the absorption cross-section whose maximum value is of 2.2×10^{-20}cm^2 at 976nm. The fluorescence lifetime was measured using a pulsed laser excitation from a OPO pumped by a frequency doubled Nd:YAG laser and the infrared pumping was performed with a GaAlAs laser diode; the fluorescence effective linewidth is of 86nm. These measurements were performed at IPEN. This work is supported by FAPESP, FATEC-SP and IPEN.

[Painel - 14:00]

Fabrication of microlenses on the end of a fiber using CO_2 laser

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Uses of microlenses on the end of fiber optics are growing day by day. They can, for example, be used to improve the laser to fiber coupling efficiency, in optical communications systems, and the pumping efficiency, in dye laser pumped by copper laser systems. They can also be utilized in diode lasers with expanded cavity, enlarging the output optical frequency spectrum, and even as the probe of near field scanning microscopes. Conventional methods of microlenses fabrication use electrical discharges in voltaic arc to fuse and shape the fiber end to the appropriate profile. However, electrical discharges seem to be not suitable to fibers of 4000 nm of external diameter. Hence, in this pilot work, it is proposed a similar way of microlens fabrication using a CW CO_2 laser beam instead of voltaic arcs. Two schemes were tested. In the first one, the fiber is placed between a focusing lens and a concave mirror, exactly at the focal length of both. In the second one, the fiber is positioned just opposite the laser beam, after a focusing lens. Preliminary results indicate that conical or spherical profiles can be easily made on the fiber end simply controlling the laser beam intensity and the pulling velocity.

ÓPTICA (Lasers e Instrumentação Óptica) – 18/05/2001

[Painel - 14:00]

DYE LASER AMPLIFIER SYSTEM PUMPED BY COPPER VAPOR LASER USING FIBER OPTIC BEAM DELIVERY FOR BOTH PUMPING AND INJECTION

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We present a dye laser amplifier system pumped by copper vapor laser that uses fiber optic beam delivery device for pumping and injecting the power to be amplified. In high-gain devices, particularly under strong pumping conditions, considerations about amplified spontaneous emission are of fundamental importance to optimize the operation characteristics. Furthermore, the amplified spontaneous emission can spoil the spectral width of dye laser system lowering the selectivity in the uranium atomic vapor laser isotope separation process. Hence, these beam delivery devices can improve the stability and flexibility of the alignment as well as eliminate the amplified spontaneous emission. An appropriate fiber length avoids the coupling of the amplified spontaneous emission into the dye oscillator. Besides that, due to its small diameter, the fiber also works as a spatial filter and helps to reduce the amplified spontaneous emission. Fiber-optic beam delivery systems are replacing conventional mirror systems because their flexibility, stability and easy alignment. Commercial products are available that use fiber optic delivery for laser surgery and materials processing. Many laser wavelengths have been transported through optical fiber and high power delivery has been reported for argon, Nd:YAG, and excimer lasers. However, few papers have been published about fiber optical beam delivery systems in a visible range, in special for dye laser amplifiers pumped by copper vapor lasers. Although the fiber optic spoils the laser mode and the laser beam divergence, it improves the laser power distributions. Concluding we can say that this fiber- optic beam deliver is very convenient to transport the optical beam, to improves the optic flexibility and alignment stability and to reduce the ASE to a typical MOPA configuration used to AVLIS purpose.