졸-겔법을 이용한 광증폭기의 Er 이온 캡슐화 및 광학적 특성
Encapsulation and optical properties of Er3+ ions for planar optical amplifiers via sol-gel process

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The fast evolution in the field of optical communication systems demands powerful optical information treatment. These functions can be performed by integrated optical systems. A key component of such systems is erbium doped waveguide amplifier(EDWA). The intra 4f radiative transition of Er at 1.5 ㎛ is particularly interesting because this wavelength is standard in optical telecommunications. The fabrication of waveguide amplifier for integrated optics using sol-gel process has received an increasing attention. Potential advantage of lower cost by less capital equipment and easy processing makes this process an attractive alternatives to conventional technologies like flame hydrolysis deposition, ion exchange and chemical vapor deposition, etc. In addition, sol-gel process has been found to be extremely suitable for the control of composition and refractive index related directly with optical properties. The main drawback of such an amplifier with respect to the EDWA is the need for a much higher Er3+ concentration to compensate for the smaller interaction length. However, the high doping of Er might be resulted in the non-radiative relaxation by clustering of Er ions and co-operative upconversion. In order to solve this problem, we investigate the possibility of avoiding short Er-Er distances by encapsulation of Er3+ ions in hosts such as organic-inorganic hybrid materials. For inorganic-organic hybrid sols, methacryloxypropyltrimethoxysilane(MPTS), zirconyl chloride octahydrate and erbium(III) chloride hexahydrate were used as starting materials, followed by conventional sol-gel process. It was observed by TEM that nano sols having core/shell toplology were formed, depending on the mole ratio of Zr/Er. The surface roughness for the coatings on Si substrate was investigated by AFM as a function of Zr/Er ratio. The local environment and vibrational properties of Er3+ ions were studied using Near-IR, FT-IR, and UV/Vis spectroscopy. Nano hybrid coatings derived from polymer and Er doped encapsulation gave the good luminescence at 1.55㎛.