Waveguide Optical Matrix 용 졸-겔 코팅졸의 OH 함량 제어 (Control of Hydroxyl Group Content in Sol-Gel-Derived Sols for Waveguide Optical Matrix)

한국화학연구원, 안복엽, 석상일, 김주현, 권정오

Recently, with the rapid development of the waveguide division multiplexing (WDM) systems for large capacity and flexibility of information network, the broad band 1.5 ㎛ erbium-doped waveguide amplifier (EDWA) become important. The main factors affecting the performance of sol-gel-based waveguides are non-radiative relaxation channels due to rare-earth concentration quenching and to vibration of the OH groups Therefore, the sol-gel process has to be carefully controlled in order to minimize the residual OH content.

In this work, a novel synthesis of the OH-controlled coating matrices by a hydrolytic/nonhydrolytic sol-gel reaction was presented. Silicon(IV) chloride (Aldrich), tetraethyl orthosilicate (Acros) were used as received. All of the preparation was carried out under N_2. The preparation of the coating matrices involved two steps of reaction: (1) Hydrolysis and condensation of tetraethyl orthosilicate by hydrolytic reaction to form $(Si-O-Si)_n(OH)_x(OR)_y$, (2) Nonhydrolytic sol-gel reaction of $SiCl_4$ with $(Si-O-Si)_n(OH)_x(OR)_y$ as an oxygen donor under nonaqueous conditions. The correlation between $SiCl_4$ and $(Si-O-Si)_n(OH)_x(OR)_y$ was investigated as a function of OH contents by means of FTIR, viscosity, GPC, ^{29}Si-NMR.

Hydrolytic/nonhydrolytic two step sol-gel process was effective to minimize the residual OH content in coating matrices, and as.-prepared coatings formed siloxane network even at room temperature. The formation of siloxane network and the OH elimination mechanisms were assumed in scheme 1.

Scheme 1. Formation of silicon oxide via hydrolytic/nonhydrolytic sol-gel reaction