Study of O$_3$-TEOS SiO$_2$ Cladding for Silicon Photonics Devices

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Silicon Photonics (SiPh) is a promising technology for large-capacity and wide-band data communications for the distance from millimeter to 100 meters which corresponded well to data center applications. This paper describes about O$_3$-TEOS SiO$_2$ film developments as an upper cladding over Si waveguide core fabricated on silicon-on-insulator wafers. It was compared with a plasma-enhanced chemical-vapor-deposition (PE-CVD) SiO$_2$ film used widely as the cladding material. The O$_3$-TEOS SiO$_2$ showed very high gap-fill characteristic at parallel arrangement of two waveguides. However, its propagation loss was 1.83 dB/cm which is three times larger than that of the conventional PE-CVD SiO$_2$ cladding. Chemical analyses by FT-IR and TDS for these two types of cladding films were carried out to clarify this reason. It was clearly shown that remained water within the O$_3$-TEOS SiO$_2$ cladding could cause the larger propagation loss by O-H stretching absorption. The water exclusion procedure should be developed to apply O$_3$-TEOS SiO$_2$ for the cladding materials. This work was supported by NEDO.

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