ROLE OF OXYGEN IN IMPROVING 1.54 μm Er^{3+} LUMINESCENCE FROM SILICON. Jung H. Shin[1], G. N. van den Hoven, and A. Polman, FOM-Institute for Atomic and Molecular Physics (AMOLF). Kruislaan 407, 1098 SJ Amsterdam, The Netherlands.

Much effort has recently been put into understanding and controlling the 1.54 μm luminescence from erbium doped silicon, as this might provide the breakthrough connection between silicon-based integrated circuit technology and opto-electronics which so far has not been possible due to the inability of silicon to generate sufficient light. Special attention needs to be paid to the role the impurities such as oxygen play in improving the erbium luminescence, as so far room temperature erbium luminescence is achieved only with such impurities. Here we present results of a comprehensive study of influence of oxygen on erbium luminescence spectra, intensity, and time evolution of luminescence intensity as we vary the oxygen concentration, annealing time, and the measurement temperature. From the results, we conclude: contrary to previous assertions, oxygen is neither necessary for erbium luminescence in silicon, nor does it provide a special site for luminescence; oxygen delays the onset of the temperature quenching of luminescence intensity, but does not provide an alternate mechanism; one important role of oxygen is stabilization of erbium against precipitation, up to 1150 °C. These conclusions are discussed in terms of impurity-Auger excitation mechanism of erbium in silicon.

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