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Si/Si:Er Multi-Nanolayers for Silicon Photonics NGUYEN QUANG VINH, FOM Institute for Plasma Physics "Rijnhuizen", P.O. Box 1207, NL-3430 Nieuwegein, The Netherlands, TOM GREGORKIEWICZ, Van der Waals - Zeeman Institute, University of Amsterdam, Valckenierstraat 65, NL-1018 XE Amsterdam, The Netherlands — Si/Si:Er multi-nanolayer structures grown by sublimation MBE technique exhibit unusual optical properties which make them very interesting for photonic applications. In particular, our recent investigations have proven that a particular type of an Er-related optically active center is preferentially formed in this material. The microscopic structure of this center (labelled Er-1) is characterized by high symmetry type (orthorhombic) and comprises a single Er3+ ion most and multiple oxygen ligands, most likely in its direct surrounding. Consequently, emission from that center does not suffer from inhomogeneous broadening typical for Si:Er materials prepared by ion implantation, and the spectrum at low temperature is characterized by an ultra-narrow linewidth of $\Delta \leq 10$ μeV. This makes Si/Si:Er multi-nanolayers attractive for Si photonics. In the contribution, we will review properties of Er- related optical centers formed in the multi-nanolayer structures as revealed by high-resolution, time-resolved photoluminescence, excitation and magneto-optical spectroscopies. In particular, the following issues will be addressed: - Details of microscopic structure of the Er-1 center. - Excitation cross-section and its variation upon excitation wavelength (band-to-band vs. subbandgap pumping) and mode (cw vs. pulsed). - The percentage of optically active Er-related centers in comparison to the total concentration of Er atoms. - Fast components appearing in the decay kinetics at high pumping rate and Auger quenching. Based on the experimental findings, potential of Si/Si:Er nanolayers for silicon photonics will be discussed. [1] N. Q. Vinh et al Phys. Rev. Lett. 90, 066401 (2003) [2] N. Q. Vinh et al Phys. Rev. B 70, 115332 (2004).

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