HIGH PRESSURE SPECTROSCOPY OF Pr$^{3+}$ DOPED LiNbO$_3$ CRYSTAL.

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Rare earth doped LiNbO$_3$ crystals are intensively investigated due to their electro-optic acousto-optic and nonlinear properties. Pr$^{3+}$ is an interesting activator since offers the variety of emission transition from UV to IR spectral region. In LiNbO$_3$ however the most intensive emission appears due to the $^1D_2 \rightarrow ^4H_4$ transition at about 630nm. The emission from $^1S_0$ and $^3P_0$ states is effectively quenched by the nonradiative transfer from the Pr$^{3+}$ to the localized exciton system. We have used high pressure applied in diamond anvil cell to influence the energy of the states belonging to the 4f$^2$ electronic configuration as well as the energy of bound exciton states. In this contribution we present the luminescence spectra obtained at pressure range up to 200kbar, at temperature range 20-300 K. We have found the pressure shift of the $^1D_2 \rightarrow ^4H_4$ and $^1D_2 \rightarrow ^4H_5$ transitions to be of the range $-2\text{cm}^{-1}/\text{kbar}$. We have also found the that energy of the localized exciton states diminishes with pressure. As the result at pressures above 80kbar apart of the sharp $^1D_2 \rightarrow ^4H_4$ emission the broad band luminescence peaked at about 850 nm appears. We have investigated the ratio of the intensity of this broad band emission to the intensity of the sharp lines luminescence for different pressures and temperatures. We were able to estimate the energy barrier for nonradiative processes as well as the radiative and non-radiative transitions probabilities for process originating at the $^1D_2$ state. Another quantitative result is a quantity of pressure shift of the energy of bound exciton the ground state which is equal approximately to $20\text{cm}^{-1}/\text{kbar}$.

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