Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Temperature and intensity dependent quenching of light emission in Alq_3 films NIRANJALA WICKREMASINGHE, AHAMED M. AJWARD, XIAOSHENG WANG, HANS PETER WAGNER, Department of Physics, University of Cincinnati — We investigate the light emission in aluminum quinoline (Alq_3) films as a function of cw laser excitation intensity at temperatures ranging from 15 to 300 K by measuring the spectrally-integrated (SI) photoluminescence (PL) with a photodiode. In addition we study the time-resolved (TR) PL as a function of 100 fs pulse fluence. The Alq_3 films were grown on a Si substrate using organic molecular beam deposition. In SI PL measurements at low temperatures (15 K) we observe PL quenching which is rising with increasing excitation intensities and saturating at highest intensities. The PL quenching is attributed to exciton-exciton annihilation of trapped excitons at nanocrystal grain boundaries. The saturation is explained by the limited density of available traps. This observation is in agreement with TR PL traces which show an increasingly non-exponential decay with rising pulse fluence and saturation at high excitation. With increasing temperature (30 to 170 K) the annihilation process is reduced due to thermally activated occupation of non-quenchable exciton states. Above 190 K the PL efficiency decreases because of thermally activated de-trapping of excitons and subsequent migration to non-radiative centers. Our experimental results are supported by a coupled rate equation model.

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Date submitted: 15 Nov 2013 Electronic form version 1.4