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A New Model with Internal and External Traps explaining Fluorescence Intermittency in a Quantum Dot Studied with Scanning Tunneling Spectroscopy SEONG JOON LIM, Seoul Nat'l University, Korea, OLEG V. PREZHDO, University of Rochester, United State, MINJUN LEE, JEONGHOON KWON, Seoul Nat'l University, Korea, KYUNG-SANG CHO, BYOUNG LYONG CHOI, Samsung Advanced Institute of Technology, Korea, YOUNG KUK, Seoul Nat'l University, Korea — Recent studies on fluorescence intermittency, or called blinking, in quantum dots (QDs) show that complete control of this phenomenon is near at hand. Although a number of models deal with the transitions between on/off states in the intermittency, they do not consider the spatial and energy distribution of traps in a single QD. In this study, we measured the spatial and energy distribution of traps using scanning tunneling microscopy and spectroscopy. The trap states of CdSe/ZnS QD exhibit two distinct energy states and intensities in the tunneling spectra according to their residing positions (inside or surface of QD). We were able to simulate trapping dynamics of the fluorescence intermittency from the measured energy and spatial distribution. We used Monte Carlo method to render transitions between the trap states in this model. We can successfully explain the power-law distribution of on/off time, which is a characteristic feature of the blinking. The dependence is a consequence of a two-step trapping process through inner and surface traps. The simulation also predicts the suppression of the long tail in the power-law distribution by reducing the surface traps. This result is in good agreement with a recent fluorescence lifetime-intensity distribution measurement.

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