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A Model for the Powerlaw Behavior of Blinking Dynamics of Single Quantum Dots SUNNEY XIE, Harvard University, PENG CHEN, Harvard University, JOHN KRUG, NIST, KANG TAEK LEE, Seoul National University — Quantum dots (QDs) are a new generation of fluorescent markers for biological labeling with exceptional optical properties. However, single QD fluorescence blink due to a photo-induced electron transfer (ET) process, where the QD core loses an electron to a surface based trap site generating a non-fluorescent core-shell charge-separated state. This QD blinking behavior complicates their imaging applications. We observed that CdSe/ZnS QD blinking is largely suppressed in cysteine and histidine solutions and provided a mechanism for the blinking suppression. Cysteine and histidine act as small molecule ligands and bind to the Zn^{II} based surface trap sites. The electronic interaction between the ligand and Zn^{II}-based trap sites raises the energy of the non-fluorescent core-shell charge-separated state and thus shuts down the photo-induced ET process, leading to blinking suppression. Based on ligand binding mechanism, we developed a model that accounts for the observed power law behavior of QD blinking kinetics.

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