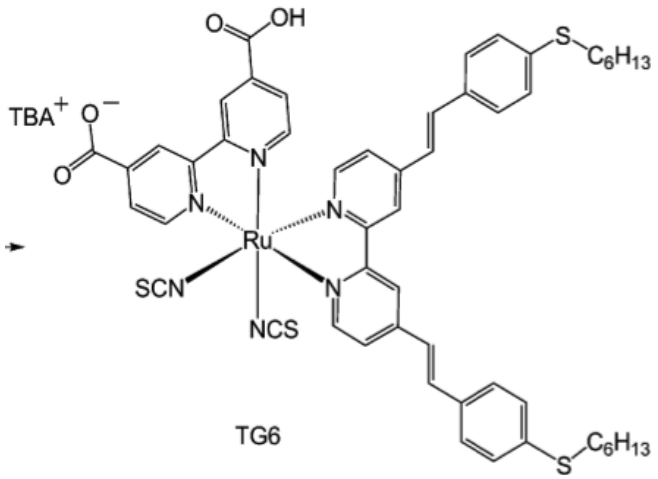
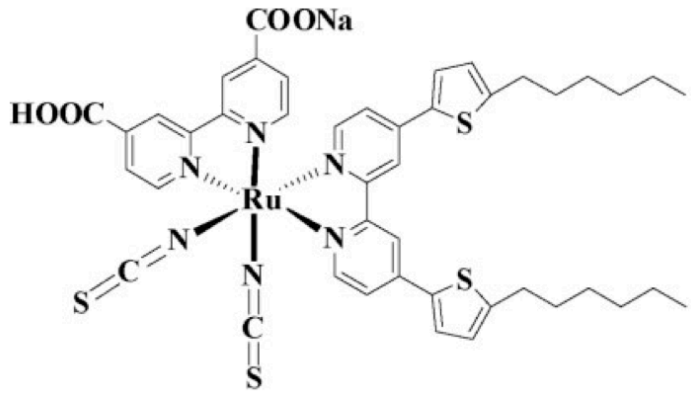
Electronic Supplementary Material (ESI) for Energy & Environmental Science

Electronic Supporting Information for:

Dye Adsorption, Desorption, and Distribution in Meso-porous TiO_2 Films, and its Effects on Recombination Losses in Dye Sensitized Solar Cells

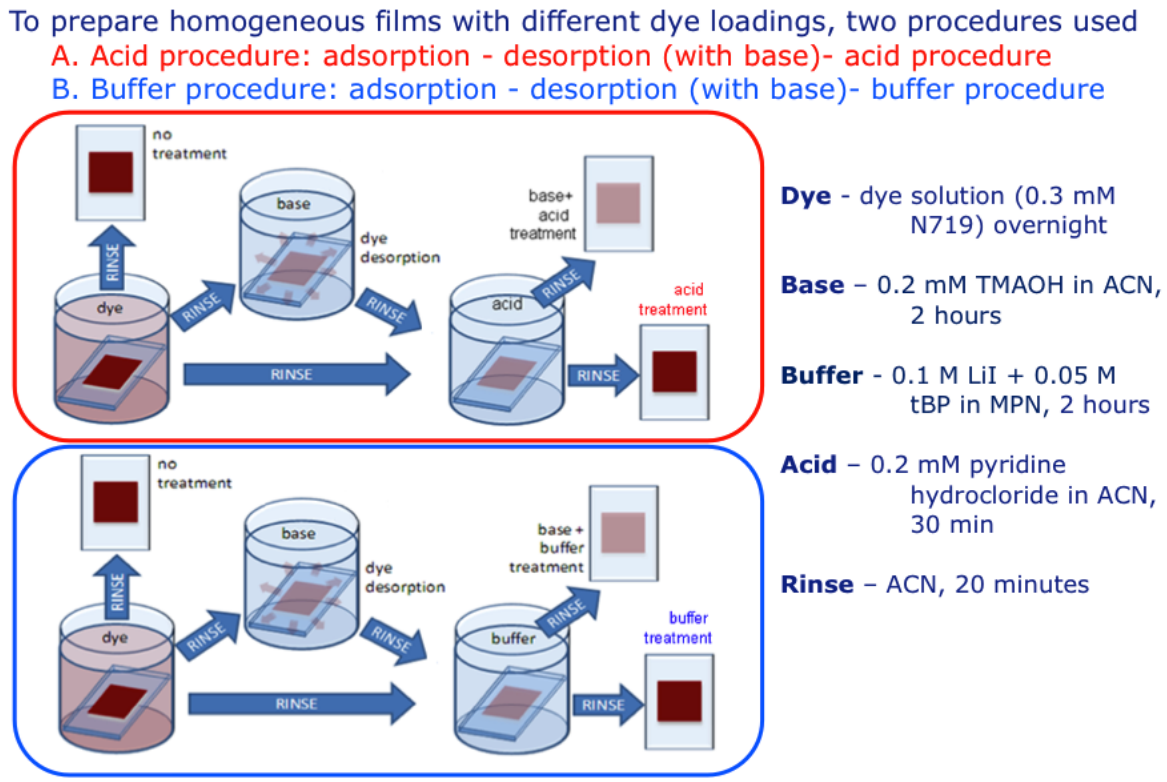
Brian O'Regan* and Li Xiaoe





Scheme S1: Dye structures of TG6 and C101.

Dye C101 was adsorbed from 0.25 mM C101 in a mixture of 10% dimethylsulfoxide (DMSO) and 90% tert-butyl alcohol and acetonitrile (1:1 v/v). TG6 was adsorbed from 0.3 mM TG6 in a mixture of chloroform and ethanol (1:1 v/v)). Dye adsorption was carried out at room temperature and for > 14 hours in each case.



Scheme S2. Schematic of the various treatments used to create partial coverage dye layers.

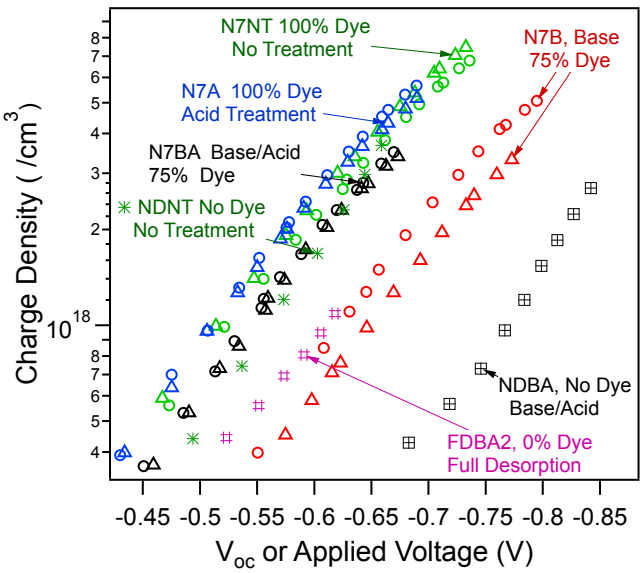


Figure S1. Charge density vs V_{oc} or applied voltage before adjustment to remove effect of differing trap density (N_t).
Compare to figure with adjustment in text.

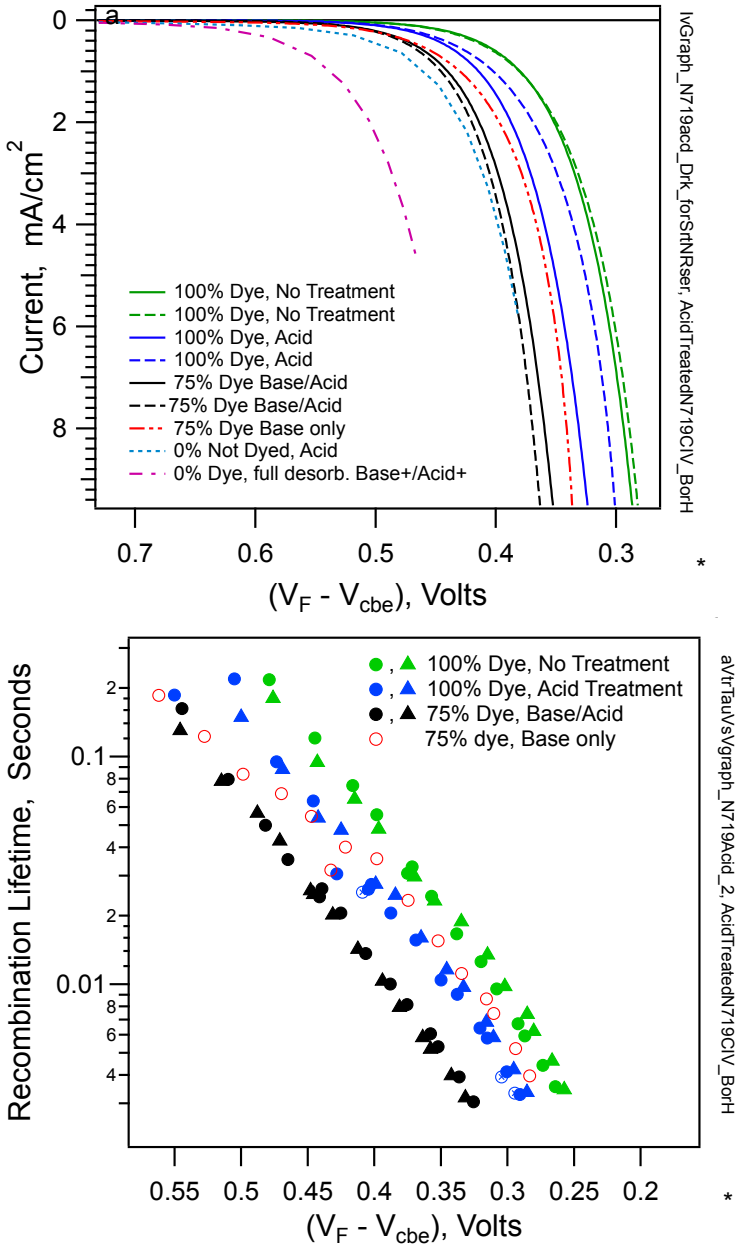


Figure S2. Recombination comparison for N719 films with various dye coverages. a) using dark current. b) using recombination lifetime.

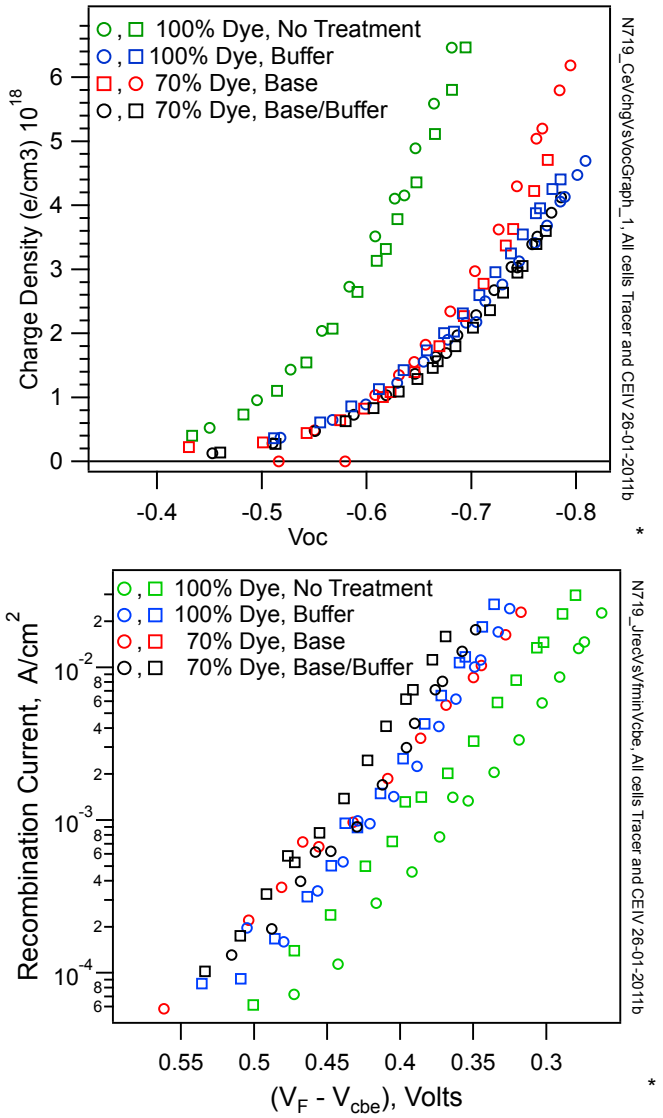


Figure S3, a) Charge vs Voc for N719 films, corrected for changes in total trap density. Buffer treatment refers to a 2 hour soak in in 10 ml acetonitrile with LiI and TBP (see methods). Previously the LiI/TBP in the cell electrolyte has been thought to achieve balanced effects of Li^+ adsorption, and TBP adsorption on TiO_2 and removal of protons. It seems that in bulk the buffer treatment \ achieves instead a similar effect as a treatment in base only, except the dye was not removed. However, in the end the conduction bands of the buffer treated and base/buffer treated films arrived at the same potential, allowing comparison of the recombination of the 70% and 100% dye coverage cells. b) Recombination current comparison for N719 cells with various treatments and dye coverages. Similar to the acid treatment vs base/acid treatment shown in figures 9 and S2, the removal of 30% of the dye causes less than a factor of two increase in recombination.

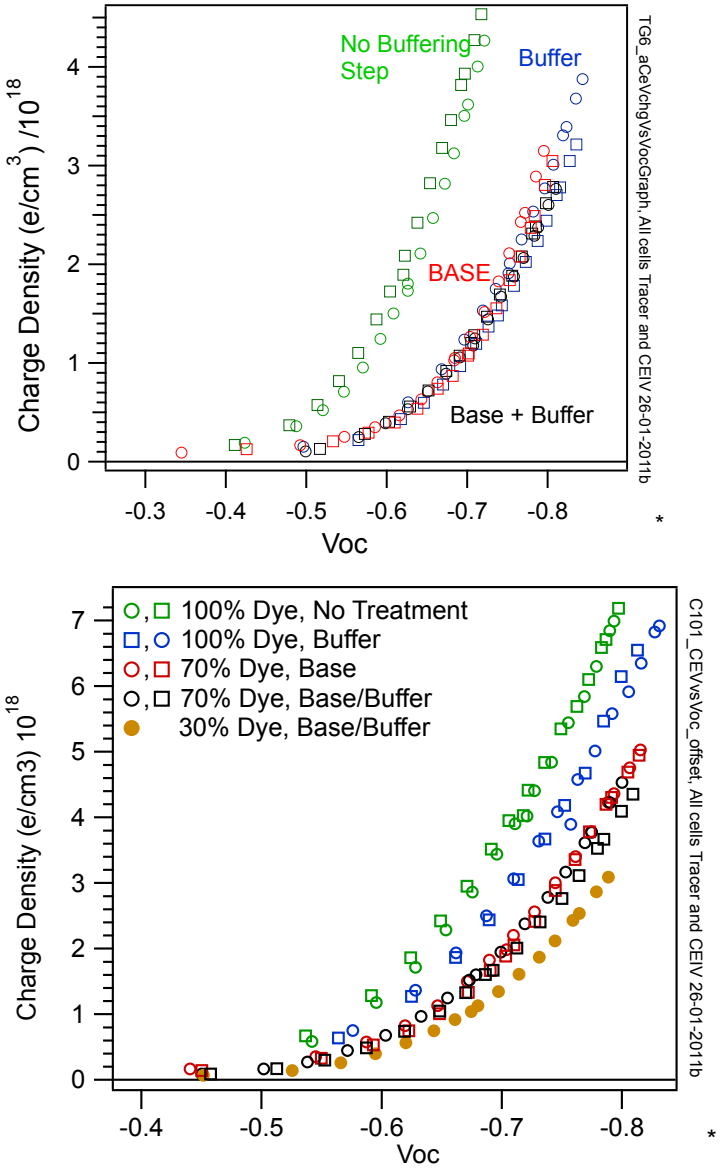


Figure S4. a) TG6 cells charge density vs Voc, corrected for changes in Nt. b) C101 cells charge density vs Voc. Both corrected for changes in Nt (total trap density). Recombination current vs V_F-V_{cbe} shown in figure 10, main text.