Effects of azobenzene self-assembled monolayer treatment solvents for efficient opto-electronic switching of polymer transistor

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Here we show that strategic choice of processing organic solvent can maximize opto-electronic switching behavior of fluorinated azobenzene (FAZO) self-assembled monolayer (SAM) on Au. Various organic solvents with diverse values of dielectric constant are tested for SAM formation of FAZO which can yield large dipole moment difference via cis-trans isomerization. Solvents with higher dielectric constant can efficiently screen electrostatic repulsion between strong electron-withdrawing fluorinated chromophores or between electron donating thiolate sulfurs, so that well-ordered tightly packed SAM is formed on Au substrate while solvents with lower dielectric constant yield disordered and loosely packed SAM. In the cases of well-ordered SAM, however, efficient photoisomerization is not possible due to steric hindrance and/or effective excitonic coupling between adjacent chromophores, while SAM processed with marginal polarity such as chloroform yielded maximized switching behavior. This work shows not only chemical structure of molecular switch but also processing condition for SAM formation is critical for optimal optoelectronic switching of molecular switch.