Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Selective crystallization of regioregularity controlled polythiophene for enhancing mechanical stability and electronic performance. HYEONG JUN KIM, KAIST, HOJEONG YU, POSTECH, JAE HAN KIM, JINSUNG KIM, TAEK SOO KIM, KAIST, JOON HAK OH, POSTECH, BUMJOON KIM, KAIST — Considering the many potential applications of organic electronics in portable electronic devices, it is of great importance to develop an electro-active material that possesses mechanical stability and high electronic performance. Coexistence of both properties, however, is very difficult to achieve because good electronic performance is associated with long conjugation length, and high crystallinity often results in stiffness and brittleness. Herein, we utilize P3HT with two different regioregularities: high RR (98%) P3HT has high electronic properties but poor mechanical resilience, and low RR P3HT (68%) exhibits high elasticity and ductility but poor electronic performance. Selective crystallization of high RR P3HT induced by solution assembly allows construction of percolated networks of high RR P3HT nanowires (NWs) embedded in low RR P3HT matrix. Only 5 wt% high RR P3HT is required to reach a hole mobility comparable to that of high RR P3HT, and high RR NWs embedded in film exhibits 20 times higher elongation at break. Selective self-assembly allows us to overcome the fragile nature of highly crystalline conjugated polymers without losing their electronic properties.

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Date submitted: 05 Nov 2015 Electronic form version 1.4