Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Synthesis of Graphene Nanoribbons with Various Widths and Its Application to Thin-Film Transistor KYUNG TAE KIM, WON HO JO, Seoul National University — Although graphene itself is a zero-bandgap semimetal, graphene nanoribbon (GNR) with a width smaller than 10 nm exhibits semiconducting behavior that renders them suitable for active materials of electronic devices. Several methods have been reported to produce GNRs, such as lithography, unzipping of CNTs, mechanical exfoliation and CVD. However, the uncontrollable character of these methods or in some case the harsh conditions restrict severely the quality of the resulting graphenes and consequently limit their applications. In this study, we synthesized GNRs with various widths from the corresponding polymer precursors and investigated their TFT properties. For synthesis of GNRs, we first synthesized polymers with phenylene, naphthalene and anthracene units by the Suzuki coupling reaction between dibromine monomer and diboronic ester monomer. The polymers were then converted into the corresponding GNRs through intramolecular cyclodehydrogenation reaction. The cyclodehydrogenation were identified quantitatively by NMR analysis. All GNR-based TFTs showed ambipolar transport behavior. The anthracene-based GNR exhibits the best TFT performance among three GNRs due to longer conjugated length, larger width and stronger π-stacking as compared to phenylene- and naphthalene-based GNRs.

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Date submitted: 15 Nov 2012 Electronic form version 1.4