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Phase Diagrams of n-Type Low Bandgap Naphthalenediimide-Bithiophene Copolymer Solutions and Blends

Gada Muleta Fanta^{1, 2*}, Pawel Jarka¹, Urszula Szeluga³, Tomasz Tanski¹ and Jung Yong Kim^{2, 4}

¹Silesian University of Technology, Poland

² Jimma University, Ethiopia

³Center of Polymer and Carbon Materials to the Polish Academy of Sciences, Poland

⁴Jimma University, Ethiopia



Abstract

I he phase diagrams of n-type low bandgap poly{(N,N'-bis(2-

octyldodecyl)naphthalene-1,4,5,8-bis(dicarboximide)-2,6-diyl)alt-5,5',-(2,2'-bithiophene)}(P(NDI2OD-T2)) solutions and blends were constructed. To this end, we employed the Flory-Huggins (FH) lattice theory for qualitatively understanding the phase behavior of P(NDI2OD-T2) solutions as a function of solvent, chlorobenzene, chloroform, and p-xylene. Herein, the polymer–solvent interaction parameter (χ) was obtained from a water contact angle measurement, leading to the solubility parameter. The phase behavior of these P(NDI2OD-T2) solutions showed both liquid-liquid (L-L) and liquid-solid (L-S) phase transitions. However, depending on the solvent, the relative position of the liquid-liquid phase equilibria (LLE) and solid-liquid phase equilibria (SLE) (i.e., two-phase coexistence curves) could be changed drastically, i.e., LLE > SLE, LLE \approx SLE, and SLE > LLE. Finally, we studied the phase behavior of the polymer-polymer mixture composed of P(NDI2OD-T2) and regioregular poly(3-hexylthiophene-2,5dyil) (r-reg P3HT), in which the melting transition curve was compared with the theory of melting point depression combined with the FH model. The FH theory describes excellently the melting temperature of the r-reg P3HT/P(NDI2OD-T2) mixture when the entropic contribution to the polymer-polymer interaction parameter ($\chi = 116.8$ K/T–0.185, dimensionless) was properly accounted for, indicating an increase of entropy by forming a new contact between two different polymer segments. Understanding the phase behavior of the polymer solutions and blends affecting morphologies plays an integral role towards developing polymer optoelectronic devices.

Biography:

I am senior lecturer at Arba Minch University since April, 2010 to up to now. Now, I am a PhD scholar at Jimma University,

Ethiopia and Silesian University of Technology, Poland, especially on research collaboration. My research work is supervised under Prof. Jung Yong Kim from Korea and Prof. Tomasz Tanski from Poland.



Speaker Publications:

- Biocide Value Characterization of Essential Oil from Boswellia neglecta S. against Pathogenic Termite, Cockroach, Ticks, Escherichia coli and Staphylococcus aureus; AD Getachew M. Fanta, Asnake G. Ede; International Journal of Modern Chemistry 5 (3), 145-158
- 2. Phase Diagrams of n-Type Low Bandgap Naphthalenediimide-Bithiophene Copolymer Solutions and Blends; GM Fanta, P Jarka, U Szeluga, T Tański, JY Kim; Polymers 11 (9), 1474
- Phase Behavior of Amorphous/Semicrystalline Conjugated Polymer Blends; GM Fanta, P Jarka, U Szeluga, T Tański, JY Kim; Polymers 12 (8), 1726
- 4. Analyzing Selected Heavy Metals Content of Compost used in Ethiopia; AGE Getachew Muleta Fanta; International Journal of Innovative and Applied Research 2 (9), 5-11

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