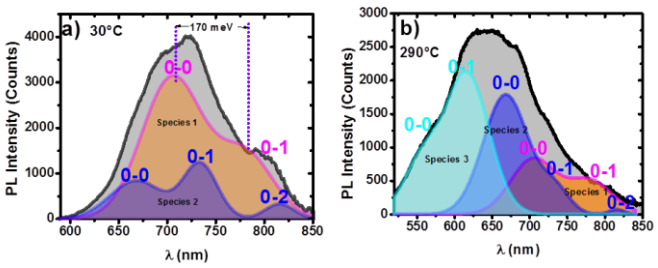
Title: **Temperature Dependent Interplay between Emitting Species in Highly Ordered Poly(thiophenes) as Revealed by Optical Spectroscopy**

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Abstract

In this study, the temperature dependent PL spectra measurement has provided us a feasible means to elucidate the nature of the emissive species and the melt transitions in different polythiophenes. The effects of thermal fluctuation on different phases of a bulky substituted poly (3-(2, 5-dioctylphenyl) thiophene) (PDOPT) and Poly(3 hexylthiopne-2 5diyl) (P3HT) have been systematically investigated using photoluminescence spectroscopy. This has been achieved by performing in-situ temperature dependent photoluminescence measurements followed by detailed spectral analysis. For PDOPT, the intensities of the emitted species varied as a function of temperature that determine degrees of order. Well-ordered crystals emitted strongly in lower energies as opposed to less ordered films and spherulitic crystals. From the deconvoluted PL spectra, it was revealed that, the emitting energy bands remained constant with shift of intensity with ordered crystals emitting strongly in higher wavelengths as compared to their disordered counterparts that emit strongly in lower wavelengths. On the other hand, for P3HT, the spectrally resolved PL lineshapes through multipeak Gaussian functions simulating 0-0, 0-1, 0-n peaks have revealed multiple vibrational replicas yielding different emitting species (states). We suggest that the temperature dependent vibronic progressions arise from different electronic origins i.e. different species (fluorophores) due to multiple crystalline polymorphs within the crystal with varied coupling of the excited states. From our observation, we conclude that it is not sufficient to invoke only the intramolecular interactions in explaining the nature of PL spectra of highly ordered polythiophenes which are widely dominated by both interchain and intrachain interactions.



Recent Publications

1. **Agumba O. John**, The Role of Solvents' Dielectric Constants in Delicate Interplay between Microstructure and Optical Properties of Poly (3-Hexylthiophene) Thin Films. *American Journal of Nanoresearch and Nanotechnology Research,* 2019, **7** (1): 1-13.

2. Solomon L. Joseph, **Agumba O. John**, Fanuel K. Mugwang, Gabriel G. Katana, Tuning the Band gap Energy of Reduced Graphene Oxide using Biopolymer Chitosan for High Power and Frequency Device Applications. *American Journal of Polymer science and Engineering,* 2019, **7** (1): 1-12.

3. Juma Hanif, **John Onyango Agumba,** Katana Gona Gabriel, The α- and β-Relaxation Processes of Polymeric Chitosan from Squid Gladii as Revealed by Dynamic Mechanical Analysis. *American Journal of Mechanical and Materials Engineering*, 2018, **2** (4): 40-45.

4. **Agumba Onyango John**, Adem Abibo Jack, The Inter-play of the Opto-Electrical Properties of Cuprite and Tenorite Semiconductors for Solar Cell Application. *American Journal of Nano Research and Applications*, 2017; **5**(6): 81-86.

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bulky substituted poly(thiophene) identified by optical spectroscopy, Macromolecules, 50:6829-6839.

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7. Yingying W, Barbara H, Daniel S, John O A, Michael So, Tao W, Günter R. (2014) Anisotropic Photophysical Properties of Highly Aligned Crystalline Structures of a Bulky Substituted Poly(thiophene), ACS Macro Lett., 3: 881−885.
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Biography

Dr. Agumba completed his PhD in Physics at St. Albert Ludwigs University-Freiburg in Germany in 2016 and is currently a lecturer of Physics at Jaramogi Oginga Odinga University of Science & Technology, Bondo, Kenya. He holds a M.Sc. degree in Physics from Kenyatta University, Kenya He heads an active research group comprising Physicists, Chemists and engineers from where they undertake a number of multidisciplinary researches. He has presented a number of talks and posters in various international conferences. He also has a nunber of publications in reputable journals. Dr. Fanuel Keheze Mugwang'a has just completed his PhD in Physics at St. Albert Ludwigs University-Freiburg in Germany.

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Notes/Comments:

This work is a culmination of research done on conjugated polymers by a team of researchers.

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