

1/5/2016 1:05 AM Entry #5

Status: Complete

Student Information

Name

Dr. Luyao Lu

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Thesis Summary

My PhD research focuses on new understandings of structure-property relationships and novel design strategies for achieving high performance polymer solar cells (PSCs). I discovered that for a high performance photovoltaic polymer, the calculated internal dipole moment change between the ground and excited states of a single repeat unit should be around 4 Debye. I unraveled the cause of high dispersity during Stille polymerization process and its influence on PSC performance. I developed the first ternary blend PSC with a power conversion efficiency (PCE) higher than 8% in 2014 and later higher than 9% in 2015. The mechanisms behind the performance improvement from the two ternary systems were carefully studied. I came up with the "cooperative plasmonic effect" from mixed metal nanostructures to enhance light absorption of PSCs, which is superior to traditional plasmonic effect from single type nanostructures. I incorporated carbon nanotubes into active layer of PSCs and achieved the world-record performance for this type of devices. I reported that the energy level alignment at the interface between charge transport layers and active layer dramatically influenced solar cell performance for a given polymer material. Last but not least, I synthesized a new series of wide band-gap photovoltaic polymers based on the N-alkyl 2-pyridone dithiophene unit with PCEs larger than 5%, which are among the highest achieved to date for wide band-gap polymers. In total, I have published 19 papers including 11 first or co-first author papers for my PhD thesis work in the PSC field.

Essay Submission

Please write a 1000-word essay describing your thesis work. No longer than 1000, please!

Please upload your 1000-word essay describing your thesis work.



Essay for Luyao Lu's application.pdf
722.71 KB

**Figures**

Figures for Luyao Lu's application.pdf
616.96 KB



Academic Background

Institution Granting your PhD
University of Chicago

Date of PhD received
3/20/2015

Field of Study

Chemistry

Thesis Title

Understanding the mechanism and exploring the optimization strategies for organic solar cells

PhD Thesis Advisor

Prof. Luping Yu

Department

Chemistry

Thesis Advisor Email Address

lupingyu@uchicago.edu

Academic Degree-2

Bachelor's in Chemistry

Date Received

6/30/2010

Institution

Nanjing University

Field of Study

Chemistry

Academic Degree-3**Date Received****Institution****Field of Study**

PhD Thesis Committee Members

*Please list all members of your Thesis Committee along with their affiliation and current email address***Committee Member 1**

Prof. Bozhi Tian

Department Affiliation

Chemistry

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Committee Member 2

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Committee Member 3

Prof. Luping Yu

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Academic and Professional Awards

Please list all awards received while a student

Received While a Student 1

Award Title

Albert J. Cross Prize for Excellence in Research, Teaching, and Departmental Citizenship

Award Date

May, 2013

Award from Institution or Organization

University of Chicago

Description of Award

The award is the highest honor from the Department of Chemistry at University of Chicago

Award Title

Graduate Student Award at the 10th Excellence in Graduate Polymer Research Symposium

Award Date

March, 2014

Award from Institution or Organization

American Chemical Society

Description of Award

This award is a recognition to outstanding graduate students in polymer science and engineering

Award Title

Chinese Government Award for Outstanding Self-financed Students Abroad

Award Date

September, 2015

Award from Institution or Organization

Chinese Government

Description of Award

This award celebrates the achievements of non-Chinese-government funded Chinese PhD students from different disciplines worldwide

Award Title**Award Date****Award from Institution or Organization****Description of Award****Award Title****Award Date****Award from Institution or Organization****Description of Award**

Selected Publications

Please provide reference to selected publications. Maximum is 8.

Item 1

List of 8 Selected Publications



Publication 1.pdf
820.46 KB

**Publication #1**

Publication 1 is my co-first author paper in Advanced Functional Materials. (Adv. Funct. Mater. 2014, 24, 3432).

Publication #2**Publication #3****Publication #4****Publication #5****Publication #6****Publication #7****Publication #8**

Item 2

List of 8 Selected Publications



Publication 2.pdf
81.50 KB

**Publication #1**

Publication #2

Publication 2 is the first page of my first author paper in Chemistry of Materials (Chem. Mater. 2015, 27, 537).

The size of the full pdf is larger than 2 MB and can't be uploaded.

Publication #3**Publication #5****Publication #7****Publication #4****Publication #6****Publication #8****Item 3****List of 8 Selected Publications**

Publication 3.pdf
75.12 KB

**Publication #1****Publication #3**

Publication 3 is the first page of my first author paper in Nano Letters (Nano Lett. 2013, 13, 59).

The size of the full pdf is larger than 2 MB and can't be uploaded.

Publication #5**Publication #7****Publication #2****Publication #4****Publication #6****Publication #8****Item 4****List of 8 Selected Publications**

Publication 4.pdf
77.94 KB

**Publication #1****Publication #3****Publication #5****Publication #7****Publication #2****Publication #4**

Publication 4 is the first page of my first author paper in Nano Letters (Nano Lett. 2013, 13, 2365).

The size of the full pdf is larger than 2 MB and can't be uploaded.

Publication #6**Publication #8****Item 5****Item 6**

List of 8 Selected Publications

Publication 5.pdf
60.62 KB

**Publication #1****Publication #2****Publication #3****Publication #4****Publication #5****Publication #6**

Publication 5 is the first page of my first author paper in Nature Photonics (Nature Photon. 2014, 8, 716). The size of the full pdf is larger than 2 MB and can't be uploaded.

Publication #7**Publication #8****List of 8 Selected Publications**

Publication 6.pdf
672.23 KB

**Publication #1****Publication #2****Publication #3****Publication #4****Publication #5****Publication #6**

Publication 6 is my first author paper in Nature Communications (Nat. Commun. 2015, 6, 7327).

Publication #7**Publication #8****Item 7****List of 8 Selected Publications**

Publication 7.pdf
637.20 KB

**Publication #1****Publication #2****Publication #3****Publication #4****Publication #5****Publication #6****Publication #7****Publication #8**

Publication 7 is my first author paper in Nature Photonics (Nature Photon. 2015, 9, 491).

Item 8

List of 8 Selected Publications

Publication 8.pdf
245.05 KB

**Publication #1****Publication #2****Publication #3****Publication #4****Publication #5****Publication #6****Publication #7****Publication #8**

Publication 8 is the first page of my first author paper in Chemical Reviews (Chem. Rev. 2015, 115, 12666). The size of the full pdf is larger than 2 MB and can't be uploaded.

I hereby affirm that the information contained in this application is accurate and complete to the best of my knowledge
Yes

I hereby affirm that I have/will have received my PhD in 2015
Yes

Name and Affiliation

Luyao Lu, University of Chicago

Upload Letter of Support**Upload Letter of Support**

IUPAC-Solvay Prize_Support Letter for Dr. Luyao Lu
76.08 KB



IUPAC-Solvay Prize_Support Letter for Dr. Luyao Lu
53.75 KB

