



## Yan Xia

Associate Professor of Chemistry

### CONTACT INFORMATION

- **Administrative Contact**

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### Bio

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#### BIO

Designing and synthesizing exotic small and giant molecules for custom properties, Assistant Professor Yan Xia works at the interface of synthetic chemistry and materials science. His research uses a combination of catalysis, organic and polymer chemistry, and a range of advanced characterizations to create, control, and study novel (macro)molecular structures and organic materials with tailored conformations, nanostructures, properties, and functions.

Research in the Xia Group combines vigorous function-driven syntheses, rational molecular design, and in-depth understanding of (macro)molecular reactivity, property, and function. Powerful synthetic methods are the enabling force behind their development of novel organic materials. They have developed various types of chemistry to generate diverse molecular ladder materials with high microporosity, antiaromaticity, or responsive behavior; controlled polymers with defined microstructures and functionalities; and dynamic polymer networks. These new molecular materials have interesting nanostructures, optoelectronic structures, mechanical properties, stimuli-responses, and assembly behaviors, for potential applications spanning separation, electronics, and health care.

Yan Xia studied chemistry at Peking University (B.S. 2002) and McMaster University (M.S. 2005), before his doctoral research on the synthesis and study of cyclic and bottlebrush polymers at California Institute of Technology with Profs. Grubbs and Kornfield (Ph.D. 2010). Following his PhD, he spent one and a half years at Dow Chemical core R&D developing materials for electronic applications, and then performed post-doctoral research on polymer-protein conjugation and assembly at Massachusetts Institute of Technology with Prof. Olsen. He joined the chemistry faculty at Stanford in the summer of 2013 to continue his longstanding interest in developing organic materials by intimately integrating synthetic chemistry with materials science.

#### ACADEMIC APPOINTMENTS

- Associate Professor, Chemistry
- Member, Bio-X

#### HONORS AND AWARDS

- Sloan Research Fellowship, Alfred P. Sloan Foundation (2019)
- Cottrell Scholar Award, Research Corporation for Science Advancement (2017)
- Thieme Chemistry Journals Award, Thieme Chemistry (2017)

- CAREER Award, National Science Foundation (2016)
- 3M Non-Tenured Faculty Award, 3M (2016)
- Terman Fellowship, Stanford (2014-16)
- Army Research Office Young Investigator Award, U.S. Army Research Laboratory, Army Research Office (2015)

## PROFESSIONAL EDUCATION

- PhD, California Institute of Technology , Chemistry (2010)
- MS, McMaster University , Chemistry (2005)
- BS, Peking University , Chemistry (2002)

## LINKS

- Xia Group: <http://xialab.stanford.edu/>

## Research & Scholarship

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### CURRENT RESEARCH AND SCHOLARLY INTERESTS

Projects at the interface of synthetic chemistry and materials science include:

1. Microporous polymer membranes for gas separations
2. Stress-responsive polymers
3. Precise control of polymer structures, architectures, and assembly
4. Dynamic polymer networks
5. Unusual conjugated pi-systems as optoelectronic materials

## Teaching

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### COURSES

#### 2020-21

- Advanced Organic Chemistry I: CHEM 221 (Aut)

#### 2019-20

- Advanced Organic Chemistry II: CHEM 223 (Win)
- Creativity in Organic Chemistry: CHEM 233C (Spr)
- Organic Chemistry Laboratory: CHEM 124 (Aut)

#### 2018-19

- Creativity in Organic Chemistry: CHEM 233A (Aut)
- Creativity in Organic Chemistry: CHEM 233B (Spr)
- Creativity in Organic Chemistry: CHEM 233C (Spr)
- Design and Synthesis of Polymers: CHEM 137 (Win)
- Organic Chemistry Seminar Presentation: CHEM 231 (Aut, Win, Spr)

#### 2017-18

- Creativity in Organic Chemistry: CHEM 233A (Aut)
- Creativity in Organic Chemistry: CHEM 233B (Spr)
- Creativity in Organic Chemistry: CHEM 233C (Spr)

- Macromolecular and Supramolecular Chemistry: CHEM 137 (Spr)
- Organic Chemistry Seminar Presentation: CHEM 231 (Aut, Win, Spr)

## STANFORD ADVISEES

### Doctoral Dissertation Reader (AC)

Ben Boswell, Yue Jiang, Rebecca McClellan

### Postdoctoral Faculty Sponsor

Dan Lee, Xianglin Yin

### Doctoral Dissertation Advisor (AC)

Kayla Barker, J.D. Feist, Matias Horst, Ashley Leibham, Jinghui Yang, KE ZHENG

## Publications

### PUBLICATIONS

- **Bicyclohexene-*peri*-naphthalenes: Scalable Synthesis, Diverse Functionalization, Efficient Polymerization, and Facile Mechanoactivation of Their Polymers.** *Journal of the American Chemical Society*  
Yang, J., Horst, M., Werby, S. H., Cegelski, L., Burns, N. Z., Xia, Y.  
2020; 142 (34): 14619–26
- **Enol Ethers Are Effective Monomers for Ring-Opening Metathesis Polymerization: Synthesis of Degradable and Depolymerizable Poly(2,3-dihydrofuran).** *Journal of the American Chemical Society*  
Feist, J. D., Xia, Y.  
2020
- **The cascade unzipping of ladderane reveals dynamic effects in mechanochemistry.** *Nature chemistry*  
Chen, Z., Zhu, X., Yang, J., Mercer, J. A., Burns, N. Z., Martinez, T. J., Xia, Y.  
2020
- **Precise Placement of Single Monomer Units in Living Ring-Opening Metathesis Polymerization** *CHEM*  
Elling, B. R., Su, J. K., Feist, J. D., Xia, Y.  
2019; 5 (10): 2691–2701
- **Benzoladderene Mechanophores: Synthesis, Polymerization, and Mechanochemical Transformation** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*  
Yang, J., Horst, M., Romaniuk, J. H., Jin, Z., Cegelski, L., Xia, Y.  
2019; 141 (16): 6479–83
- **Tunable Coacervation of Well-Defined Homologous Polyanions and Polycations by Local Polarity** *ACS CENTRAL SCIENCE*  
Lou, J., Friedowitz, S., Qin, J., Xia, Y.  
2019; 5 (3): 549–57
- **Dynamic Hyaluronan Hydrogels with Temporally Modulated High Injectability and Stability Using a Biocompatible Catalyst.** *Advanced materials (Deerfield Beach, Fla.)*  
Lou, J., Liu, F., Lindsay, C. D., Chaudhuri, O., Heilshorn, S. C., Xia, Y.  
2018; 30 (22): e1705215
- **Streamlined Synthesis of Polycyclic Conjugated Hydrocarbons Containing Cyclobutadienoids via C-H Activated Annulation and Aromatization.** *Journal of the American Chemical Society*  
Jin, Z., Teo, Y. C., Zulaybar, N. G., Smith, M. D., Xia, Y.  
2017; 139 (5): 1806–1809
- **Mechanochemical unzipping of insulating poly(ladderene) to semiconducting polyacetylene** *Science*  
Chen, Z., Mercer, J. A., Zhu, X., Romaniuk, J. A., Pfattner, R., Cegelski, L., Martinez, T. J., Burns, N. Z., Xia, Y.  
2017; 357 (6350): 475–479

- **Regioselective Synthesis of [3]Naphthylenes and Tuning of Their Antiaromaticity.** *Journal of the American Chemical Society*  
Jin, Z., Teo, Y. C., Teat, S. J., Xia, Y.  
2017; 139 (44): 15933–39
- **Efficient Synthesis of Rigid Ladder Polymers via Palladium Catalyzed Annulation.** *Journal of the American Chemical Society*  
Liu, S., Jin, Z., Teo, Y. C., Xia, Y.  
2014; 136 (50): 17434–17437
- **Ring-Opening Metathesis Polymerization of 1,1-Disubstituted 1-Methylcyclopropenes** *MACROMOLECULES*  
Su, J. K., Lee, S., Elling, B. R., Xia, Y.  
2020; 53 (14): 5833–38
- **Catalytic Arene (oxa)Norbornene Annulation (CANAL)** *TRENDS IN CHEMISTRY*  
Leibham, A. M., Xia, Y.  
2020; 2 (7): 680–81
- **Systematic investigation of synthetic polyelectrolyte bottlebrush solutions by neutron and dynamic light scattering, osmometry, and molecular dynamics simulation** *JOURNAL OF CHEMICAL PHYSICS*  
Horkay, F., Chremos, A., Douglas, J. F., Jones, R. L., Lou, J., Xia, Y.  
2020; 152 (19)
- **Facile Synthesis and Study of Microporous Catalytic Arene-Norbornene Annulation-Troger's Base Ladder Polymers for Membrane Air Separation** *ACS MACRO LETTERS*  
Ma, X., Lai, H. H., Wang, Y., Alhazmi, A., Xia, Y., Pinnau, I.  
2020; 9 (5): 680–85
- **Degradable Polyacetals/Ketals from Alternating Ring-Opening Metathesis Polymerization** *ACS MACRO LETTERS*  
Elling, B. R., Su, J. K., Xia, Y.  
2020; 9 (2): 180–84
- **Arm-degradable star polymers with crosslinked ladder-motif cores as a route to soluble microporous nanoparticles** *POLYMER CHEMISTRY*  
Teo, Y., Lai, H. H., Xia, Y.  
2020; 11 (2): 265–69
- **Tuning the Reactivity of Cyclopropenes from Living ROMP to Single Addition and AROMP via Simple Substituents.** *Angewandte Chemie (International ed. in English)*  
Su, J. K., Jin, Z., Zhang, R., Lu, G., Liu, P., Xia, Y.  
2019
- **Tuning the Molecular Weights, Chain Packing, and Gas-Transport Properties of CANAL Ladder Polymers by Short Alkyl Substitutions** *MACROMOLECULES*  
Lai, H. H., Benedetti, F. M., Jin, Z., Teo, Y., Wu, A. X., De Angelis, M., Smith, Z. P., Xia, Y.  
2019; 52 (16): 6294–6302
- **Varying PEG density to control stress relaxation in alginate-PEG hydrogels for 3D cell culture studies** *BIOMATERIALS*  
Nam, S., Stowers, R., Lou, J., Xia, Y., Chaudhuri, O.  
2019; 200: 15–24
- **Microporous Polyimides from Ladder Diamines Synthesized by Facile Catalytic Arene-Norbornene Annulation as High-Performance Membranes for Gas Separation** *CHEMISTRY OF MATERIALS*  
Abdulhamid, M. A., Lai, H. H., Wang, Y., Jin, Z., Teo, Y., Ma, X., Pinnau, I., Xia, Y.  
2019; 31 (5): 1767–74
- **Varying PEG density to control stress relaxation in alginate-PEG hydrogels for 3D cell culture studies.** *Biomaterials*  
Nam, S., Stowers, R., Lou, J., Xia, Y., Chaudhuri, O.  
2019; 200: 15–24
- **Facile Synthesis of Macromonomers via ATRP-Nitroxide Radical Coupling and Well-Controlled Brush Block Copolymers** *MACROMOLECULES*  
Teo, Y., Xia, Y.  
2019; 52 (1): 81–87

- **Dinaphthobenz[1,2:4,5]dicyclobutadiene with Strong Antiaromaticity and Orthogonally Tunable Electronics and Packing.** *Angewandte Chemie (International ed. in English)*  
Jin, Z., Yao, Z., Barker, K. P., Pei, J., Xia, Y.  
2018
- **Iterative Synthesis of Edge-Bent [3]Naphthylene** *SYNLETT*  
Jin, Z., Teo, Y., Teat, S. J., Xia, Y.  
2018; 29 (19): 2547–51
- **Synthesis and Mechanochemical Activation of Ladderene-Norbornene Block Copolymers.** *Journal of the American Chemical Society*  
Su, J. K., Feist, J. D., Yang, J., Mercer, J. A., Romaniuk, J. A., Chen, Z., Cegelski, L., Burns, N. Z., Xia, Y.  
2018; 140 (39): 12388–91
- **Synthesis of Cyclobutadienoid-Fused Phenazines with Strongly Modulated Degrees of Antiaromaticity.** *Organic letters*  
Teo, Y. C., Jin, Z., Xia, Y.  
2018; 20 (11): 3300–3304
- **Efficient and Facile End Group Control of Living Ring-Opening Metathesis Polymers via Single Addition of Functional Cyclopropenes** *ACS MACRO LETTERS*  
Elling, B. R., Xia, Y.  
2018; 7 (6): 656–61
- **A bright organic NIR-II nanofluorophore for three-dimensional imaging into biological tissues** *NATURE COMMUNICATIONS*  
Wan, H., Yue, J., Zhu, S., Uno, T., Zhang, X., Yang, Q., Yu, K., Hong, G., Wang, J., Li, L., Ma, Z., Gao, H., Zhong, et al  
2018; 9: 1171
- **Stress Relaxing Hyaluronic Acid-Collagen Hydrogels Promote Cell Spreading, Fiber Remodeling, and Focal Adhesion Formation in 3D Cell Culture** *Biomaterials*  
Lou\*, J., Stowers\*, R., Nam, S., Xia, Y., Chaudhuri, O.  
2018; 154: 213-222
- **Functionalized Rigid Ladder Polymers from Catalytic Arene-Norbornene Annulation Polymerization** *ACS MACRO LETTERS*  
Lai, H. H., Teo, Y., Xia, Y.  
2017; 6 (12): 1357–61
- **Synthesis of Ladder Polymers: Developments, Challenges, and Opportunities** *CHEMISTRY-A EUROPEAN JOURNAL*  
Teo, Y., Lai, H. H., Xia, Y.  
2017; 23 (57): 14101–12
- **Stress relaxing hyaluronic acid-collagen hydrogels promote cell spreading, fiber remodeling, and focal adhesion formation in 3D cell culture.** *Biomaterials*  
Lou, J., Stowers, R., Nam, S., Xia, Y., Chaudhuri, O.  
2017; 154: 213–22
- **Ring-opening metathesis polymerization of 1,2-disubstituted cyclopropenes** *CHEMICAL COMMUNICATIONS*  
Elling, B. R., Su, J. K., Xia, Y.  
2016; 52 (58): 9097-9100
- **Importance of Macromonomer Quality in the Ring-Opening Metathesis Polymerization of Macromonomers** *MACROMOLECULES*  
Teo, Y. C., Xia, Y.  
2015; 48 (16): 5656-5662
- **Living Alternating Ring-Opening Metathesis Polymerization Based on Single Monomer Additions** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*  
Elling, B. R., Xia, Y.  
2015; 137 (31): 9922-9926
- **Synthesis and Direct Imaging of Ultrahigh Molecular Weight Cyclic Brush Polymers** *ANGEWANDTE CHEMIE-INTERNATIONAL EDITION*  
Xia, Y., Boydston, A. J., Grubbs, R. H.  
2011; 50 (26): 5882-5885
- **Efficient Synthesis of Narrowly Dispersed Brush Copolymers and Study of Their Assemblies: The Importance of Side-Chain Arrangement** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*

Xia, Y., Olsen, B. D., Kornfield, J. A., Grubbs, R. H.  
2009; 131 (51): 18525-18532

● **Ring-Expansion Metathesis Polymerization: Catalyst-Dependent Polymerization Profiles** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*

Xia, Y., Boydston, A. J., Yao, Y., Kornfield, J. A., Gorodetskaya, I. A., Spiess, H. W., Grubbs, R. H.  
2009; 131 (7): 2670-2677

● **Well-defined liquid crystal gels from telechelic polymers** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*

Xia, Y., Verduzco, R., Grubbs, R. H., Kornfield, J. A.  
2008; 130 (5): 1735-1740