



Unterstützt von / Supported by



Alexander von Humboldt
Stiftung / Foundation

Polymer Chemistry in Metal-Organic Frameworks

Takashi Uemura*

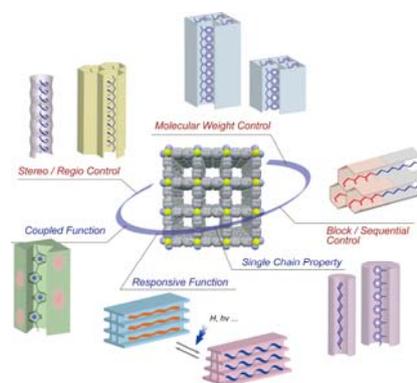
Department of Advanced Materials Science, Graduate School of Frontier Sciences, The University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8561, JAPAN

t-uemura@k.u-tokyo.ac.jp

<http://park.itc.u-tokyo.ac.jp/uemura/en/index.html>



Recently, Metal-Organic Frameworks (MOFs) composed of metal ions and organic ligands have been extensively studied. The characteristic features of MOFs are highly regular channel structures, controllable channel sizes approximating molecular dimensions, and designable surface functionality. Use of their regulated and tunable channels for a field of polymerization allows multi-level controls of resulting polymer structures.¹ In addition, construction of nanocomposites between MOFs and polymers provides unprecedented material platforms to accomplish many nanoscale functions.¹



Controlled radical polymerization of vinyl monomers was attained in MOF nanochannels, showing many remarkable effects of pore size, shape, and functionality on the primary and assembly structures of resulting polymers.² Controlled uniaxial alignment of vinyl polymer chains was achieved by host-guest cross-polymerization.^{2d} Use of MOFs as removable templates was a promising method for the mixing of immiscible polymer pairs at the molecular level.^{2e}

Other than vinyl polymers, a variety of functional polymers, such as biopolymers³, inorganic polymers⁴, and conducting polymers⁵, could be prepared/incorporated in MOFs, providing distinctly different properties to those prepared in the bulk state because of the formation of specific polymer assemblies and conformations.

Acknowledgement

This work was supported by the JST programs and Grant-in-Aid for Scientific Research from the Ministry of Education, Culture, Sports, Science and Technology, Government of Japan.

References:

- (1) (a) *Chem. Asian J.* **2006**, *1*, 36. (b) *Chem. Soc. Rev.* **2009**, *38*, 1228. (c) *Chem. Soc. Rev.* **2017**, *46*, 3108.
- (2) (a) *Angew. Chem. Int. Ed.* **2007**, *46*, 4987. (b) *Macromolecules* **2008**, *41*, 87. (c) *J. Am. Chem. Soc.* **2010**, *132*, 4917. (d) *Nature Chem.* **2013**, *5*, 335. (e) *Nature Commun.* **2015**, *6*, 7473. (f) *Nature Commun* **2018**, *9*, 329.
- (3) (a) *Nature Mater.* **2012**, *11*, 1081. (b) *Nano Lett.* **2015**, *15*, 4019. (c) *Chem. Commun.* **2016**, *52*, 5156. (d) *ACS Appl. Mater. Interface* **2017**, *9*, 11373.
- (4) (a) *J. Am. Chem. Soc.* **2008**, *130*, 9216. (b) *J. Am. Chem. Soc.* **2015**, *137*, 5231.
- (5) (a) *Nature Mater.* **2011**, *10*, 787. (b) *J. Am. Chem. Soc.* **2012**, *134*, 4501. (c) *Angew. Chem. Int. Ed.* **2016**, *55*, 708. (d) *J. Am. Chem. Soc.* **2016**, *138*, 10088. (e) *Nature Commun.* **2018**, *9*, 1660.