**[Design and synthesis of mixed-graft block copolymers for the next generation multifunctional materials](https://acs.digitellinc.com/acs/live/22/page/677/3?eventSearchInput=&eventSearchDateTimeStart=&eventSearchDateTimeEnd=&eventSearchTrack%5b%5d=201" \l "sessionCollapse393956)**

[*Ruiqi Liang*](https://acs.digitellinc.com/acs/live/22/page/677/3?eventSearchInput=&eventSearchDateTimeStart=&eventSearchDateTimeEnd=&eventSearchTrack%5b%5d=201) *and [Mingjiang Zhong](https://acs.digitellinc.com/acs/live/22/page/677/3?eventSearchInput=&eventSearchDateTimeStart=&eventSearchDateTimeEnd=&eventSearchTrack%5b%5d=201)*

*Yale University*

Bottom-up self-assembly of molecular building blocks to form hierarchical nanostructures across a broad range of length scales holds great promise for the synthesis of next-generation multi-functional materials. In this presentation, a synthetic platform for the preparation of multi-component graft block copolymers (GBCPs) as compositionally anisotropic molecular building blocks will be introduced for hierarchical self-assembly. For instance, a series of (A-*branch*-B)*n*-*block*-C*m* GBCPs were synthesized by sequential ring-opening metathesis polymerization of “A-*branch*-B” and “C” macromonomers (MMs), where “A-*branch*-B” represents a branched MM containing a polymerizable norbornene group tethered with both A and B polymer chains. The chemical incompatibility of A and B side chains results in intramolecular phase separation, creating a pre-organized interface of A- and B-rich substructure with an interface normal to the backbone. The C-grafted block forms a superstructure with the A/B-grafted block with a spatial periodicity determined by the characteristic length of the backbone. Four distinct hierarchical morphologies including lamellae-*in*-lamellae, lamellae-*in*-cylinders, cylinders-*in*-lamellae, and cylinders-*in*-cylinders were readily prepared by varying the lengths of the backbone or side chains. The impact of composition, molecular dimension, and environment on the resulting super- and substructures was studied by X-ray scattering and electron microscopy. (A-*branch*-B)*n*-*block*-(A-*branch*-C)*m*and (A-*branch*-B)*n*-*block*-(C-*branch*-D)*m* type GBCPs were also prepared with hierarchical morphologies containing hetero-substructures. A more scalable synthetic route that employs random copolymerization of monofunctionalized A and B MMs for the formation of the A/B-grafted block was also developed and the self-assembly behaviors were compared with the previous GBCPs containing A-*branch*-B MM.

