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Photo-Switchable Block Copolymer Self Assembly

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Block copolymers can self-assemble into well-defined, nanoscale morphologies, which are typically isotropic and lack long range order. Chemical or physical templates generated through optical lithography can direct self assembly to create morphologies with enhanced long range order and fashion them into hierarchical patterns. This ability allows the patterns formed to be optimized to be more suitable for a desired application. Alternatively, the incorporation of stimuli-responsiveness into these materials has the potential to exert similar control over long range order and pattern complexity, while also creating dynamic nanostructures with expanded functionality. Here, photo-responsive block copolymers are synthesized and their ability to undergo a change in morphology triggered by light exposure is investigated. This will allow direct spatial control to be exerted over self-assembled nanostructures produced in thin block copolymer films.

Photo-responsive block copolymers were synthesized through successive RAFT polymerisations and post-polymerisation modification reactions to yield poly(benzyl methacrylate)-b-poly(o-nitrobenzyl methacrylate). When the o-nitrobenzyl group is exposed to UV light, it degrades to reveal a carboxylic acid functional group, allowing the polymer to be switched from a structure with two aromatic blocks and low segregation strength to an aromatic and polar acid block with a large segregation strength and induce self-assembly as a result.

Samples of this material were exposed to UV radiation for varying amounts of time to achieve different degrees of o-nitrobenzyl group deprotection and different levels of segregation strength as a result. GISAXS was used to characterize the evolution of morphology during this process, taking advantage of the high sample throughput achievable through the use of a synchrotron X-ray source to characterize a large number of samples and optimize annealing conditions for the controlled evolution of nanoscale architectures in these materials.

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Keywords or phrases (comma separated)

Are you a student?

No

Do you wish to take part in the Student Poster Slam?

No

Are you an ECR? (<5 yrs since PhD/Masters)

No

What is your gender?

Male

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