In order to fabricate nano-scale structures for various applications, e.g., nanotechnology, photovoltaic devices, drug delivery etc., choice of three-dimensional (3D) structures is a key issue. Block copolymers, consisting of multiple polymer chains (blocks) connected with covalent bonds, self-assemble to form various kinds of morphologies due to immiscibility between the dissimilar blocks. We found an ABC-type triblock terpolymers self-assemble 3D helical morphology using electron tomography (ET) [1-3]. The ET observations revealed that the double-helical structure was composed of B helical microdomains around hexagonal-packed A cylinder cores in C matrix, even though none of the blocks is chiral. Under some condition, helical handedness of B domain was found to be uniform, the reason of which will be discussed with the help of computer simulation. This kind of interesting morphologies could be used as templates for materials with attractive properties.

Another way to assemble nano-structures may be to directly polymerize monomers in a controlled manner. We found that (conductive) polymers can be polymerized when electrons are injected into their monomers (Electro-polymerization) in liquid state. Namely, atmospheric Scanning Electron Microscope (ASEM) [4] was used to generate array of nano-scale pillars by irradiating focused electron beam in the monomer solution. The well-controlled pillar-morphology may be essential in some energy and optical properties.

References:

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