Theme: Completion of ArchimedeanTiling Map
by Newly-Designed Pentablock Polymers

Block polymers with incompatible components are known to form periodic patterns with mesoscopic length scales due to intramolecular phase-separation coupled with self-assembly. Their morphologies change variously depending on molecular parameters such as molecular weights, compositions and chain architectures. Among a variety of periodic and aperiodic patterns, this research focuses on cylindrical structures whose cross sections reveal two-dimensional tiling patterns. For example, AB diblock copolymers naturally show hexagonal packing, whereas ABC triblock terpolymers represent tetragonal patterns.

Among the enormous achievements in two-dimensional geometry, tilings have been extensively studied, and a series of highly periodic **"Archimedean Tiling"(AT)** patterns are particularly well-known, whose definition is "the tilings composed of regular polygons whose assembling manners of vertices are unimodal". It is well established that only twelve patterns are proved to appear, they are displayed in Figure 1. Integers are used to express each pattern, for example a honeycomb-type assembly of hexagons can be described as 6.6.6 pattern. Our group have so far found nine out of twelve patterns in polymer morphology, they are colored on the map. The most recent one is the 3.6.3.6 tiling, which is so-called the Kagome-Lattice, shown in Figure 2 from a tetrablock terpolymer of the S_1IS_2P type (S_1, S_2: polystyrene, I: polyisoprene, P: poly(2-vinylpyridine)). The **3.3.4.3.4 AT(Cairo-pentagonal tiling)** and even an aperiodic **quasicrystalline tiling with dodecagonal symmetry** have been observed from this type of terpolymers and their blends. As an extensional research, here I aim to complete this map by fabricating 3.12.12 and two 3.3.3.3.6 AT patterns from more complex pentablock polymers of the AB_1CB_2D type.

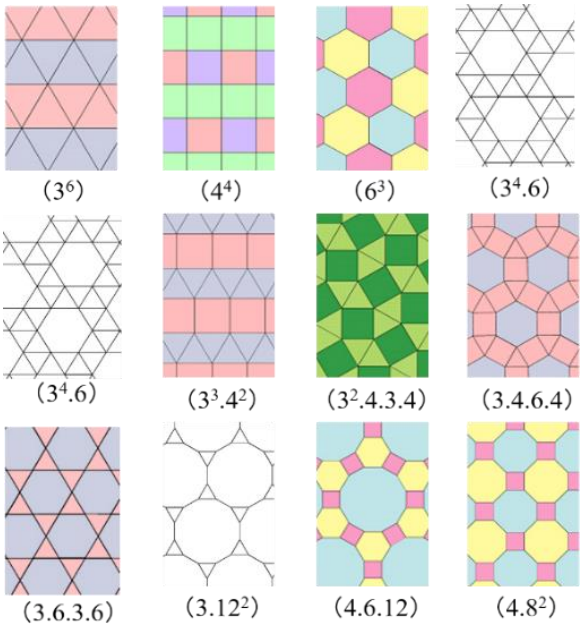

Figure 1 Archimedean tiling patterns

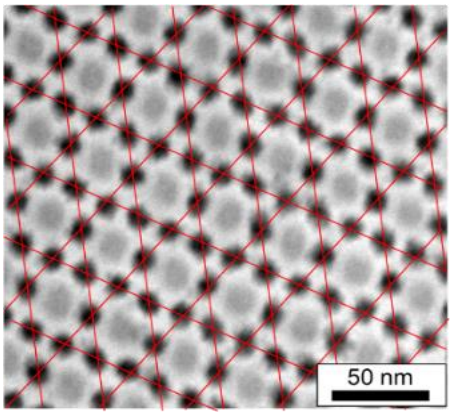

Figure 2 The 3.6.3.6 AT (Kagome-lattice) from an S_1IS_2P terpolymer