

# Kaleidoscopic Morphologies from ABC Star-shaped Terpolymers

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## 1. INTRODUCTION

Linear block copolymers such as AB diblock, ABA triblock and ABC triblock copolymers are known to show systematic morphology change among spherical, cylindrical, gyroid and lamellar structures depending on their relative compositions.[1] ABC star-shaped terpolymers, on the other hand, tend to exhibit a variety of different structures including periodic and aperiodic tiling patterns from those of linear copolymers since their junction points have to be aligned one-dimensionally. This paper introduces peculiar feature of kaleidoscopic morphology from ABC star-shaped terpolymers.

## 2. EXPERIMENTAL SECTION

Many samples of the type,  $I_xS_yP_z$ , composed of polyisoprene (I), polystyrene (S) and poly(2-vinylpyridine) (P), were prepared anionically. Particular interests were focused on two series, i.e.,  $I_{1.0}S_{1.0}P_z$ ,  $I_{1.0}S_{1.8}P_z$ . Sample films were obtained by solvent-casting and annealed at 170 °C. Morphologies were observed by TEM and microbeam SAXS.

## 3. RESULTS

Figure 1 schematically summarizes the principal achievements obtained.[2] If we look at the morphology change along with the center line, that is,  $I_{1.0}S_{1.0}P_z$ , there can be recognized a systematic morphology change from lamella-in-sphere(a), lamella-in-cylinder(b), lamella-in-lamella(h), tiling(e) and another lamellar(g) structures, all with hierarchical nature except tiling patterns. When we walk on the other line on the right hand side, i.e.,  $I_{1.0}S_{1.8}P_z$ , we meet again lamella-in-sphere(a), lamella-in-cylinder(b) cylinders-in-lamella(c), hierarchical gyroid(d) and wide tiling(e) zones. Just besides the tiling region, a characteristic zinc-blende(f) is displayed..

## 4. CONCLUSIONS

The appearance of a variety of kaleidoscopic morphologies including periodic Archimedean tiling patterns, an aperiodic quasicrystalline tiling [3] and several hierarchical structures is an exclusive feature of star-shaped terpolymers.

## REFERENCES

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3. Hayashida, K. *et al.* "Polymeric Quasicrystal: Mesoscopic Quasicrystalline Tiling in a Three-arm Star Polymers" *Phys. Rev. Lett.*, **98**, 195502 (2007)

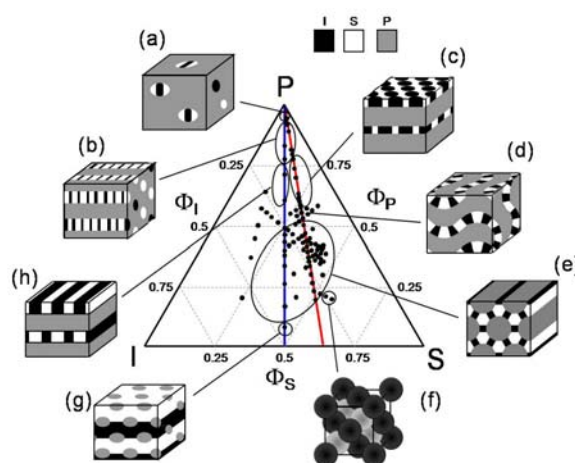


Figure 1 Triangle diagram of  $I_xS_yP_z$  star terpolymers and schematic representations of the characteristic morphology.