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NOVEL APPROACHES TO ANALYZE INTERIOR LAMELLAE AND ASSEMBLY IN SPHERULITIC MORPHOLOGY OF POLY(3-HYDROXYBUTYRIC ACID-CO-3-HYDROXYVALERIC ACID) CRYSTALLIZED WITH POLY(VINYL METHYL ETHER)

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In 2012 Woo et al. first explored the interior lamellar assembly of banded spherulites leading to optically repetitive rings in poly(ethylene adipate) (PEA). In-depth view and mechanistic correlations between top surface and interior lamellae arrangement in banded PEA were built through accurate 3D interior analyses. Ring-banded spherulites upon crystallization are common in some semicrystalline polymers including poly(3-hydroxybutyric acid-co-3-hydroxyvaleric acid) (PHBV). This study focuses on interior structure of PHBV double ring-banded spherulites. The lamellar assembly of PHBV spherulites in the blend with amorphous poly(vinyl methyl ether) (PVME) has been examined to elaborate the formation mechanisms of banded PHBV spherulites in non-isothermal and isothermal crystallization process. The behavior of PHBV spherulite crystals by continuous heating/cooling crystallization temperatures (Tcs) was recorded and analyzed by using polarized optical microscopy (POM) and scanning electron microscopy (SEM). Under POM observation, PHBV/PVME (75/25) 4 wt% exhibits double-ring banded morphology with both orange and blue color bands alternatingly arranged along radial direction at a wide temperature range (60 to 100°C). However, the band spacing and irregularity of the ring patterns on spherulites vary accordingly with Tc from wider-irregular rings at high Tc into slimmer-regular rings at low Tc. SEM (scanning electron microscope) was used to observe the interior lamellae arrangement of PHBV spherulites. Correlations between crystallization temperatures (Tcs) and interior lamellar ring-banded patterns were collected and analyzed for possible formation mechanisms.

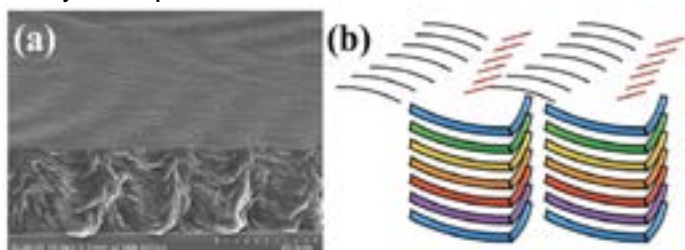


Figure 1(a) SEM micrographs revealing the interior lamellar arrangement (b) Schematic illustration for interior structure and top surface.

Recent Publications

1. C C Su, E M Woo and Y T Hsieh (2013) Perpendicularly orient lamellae in poly(3-hydroxybutyric acid-co-3-hydroxyvaleric acid) blended with an amorphous polymer: ultra-thin to thick films. *Physical Chemistry Chemical Physics*. 15(7):2495-2506.
2. A Meyer et al. (2010) Atomic-force and optical microscopy investigations on thin-film morphology of spherulites in melt-crystallized poly(ethylene adipate). *Industrial and Engineering Chemistry Research* 49(23):12084-12092.
3. E M Woo and G Lugito (2015) Origins of periodic bands in polymer spherulites. *European Polymer Journal*. 71:27-60.
4. E M Woo, L Y Wang and S Nurkhamidah (2012) Crystal lamellae of mutually perpendicular orientations by dissecting onto interiors of poly(ethylene adipate) spherulites crystallized in bulk form. *Macromolecules*. 45(3):1375-1383.
5. E M Woo, G Lugito, J H Tsai and A J Müller (2016) Hierarchically diminishing chirality effects on lamellar assembly in spherulites comprising chiral polymers. *Macromolecules*. 49(7):2698-2708.

Biography

Chung Hao Chen is a Master-Degree student in the Department of Chemical Engineering from National Cheng Kung University, Taiwan. He is currently conducting experiments under supervision of Professor Eamor M Woo in Polymer Physics Laboratory. He had an oral presentation in the Polymer Processing Society (PPS) Europe Africa Conference 2017 held in Dresden, Germany, from June 26th - June 29th, 2017. In addition, he had a poster presentation in the 8th Taiwan-Japan Bilateral Workshop on Nano-Science (2017TJBW) held from September 4th - September 5th, 2017 in National Cheng Kung University, Taiwan. He was awarded for the excellent student poster presentation. He is currently working on the project about ring-banded spherulites packed with discontinuous positive- and negative-birefringence lamellae constructed by crystallization temperature and wants to discover the growth mechanism of ring-banded spherulites by using biodegradable polymer PHBV.