

## Accessing 3D dimension on a wedding cake like SEBS block copolymer droplet

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**Abstract** – Styrene-ethylene-butylene-styrene (SEBS) copolymer structures on mica substrate were obtained by free evaporation of the solvent of a solution of SEBS/Toluene. Such structures, which are parallel to mica surface, showed different regions, and stripes and droplets form one of them. In this work we studied the morphology of such droplets and showed that they are formed by a superposition of layers, each one defined by a microphase separation between the PS and the EB. PS segments of the copolymers form cylinders disposed parallel to the surface of the substrate, and its arrangement defines the thickness of each layer.

Styrene-ethylene-butylene-styrene (SEBS) copolymer are known to form submicrometric structures, some of them self-organized, after dip-coating a solid and flat substrate in an organic solution having SEBS as the solute. In the present work we obtained different structures dipping the substrate in a SEBS/toluene 0,01% weight solution and waiting for the total evaporation of the solvent. The substrate is placed in a position that forms an angle of 15° with the vertical direction. As the solvent evaporates, and the meniscus goes down, it is possible to differentiate eight bands along the substrate; the increasing of the concentration causes the distinction among them. At the beginning, when the concentration is relatively low (~ 0.01% weight), irregular nanometric aggregates are formed, while when the solution is highly concentrated a segmented thick film is deposited. One of the intermediate bands presents a structure formed by long stripes with small droplets between them. Our current interest is to study the morphology of such droplets, whose diameters are in the 0.3 to 3 μm range. In Fig. 1 we show a phase-AFM image of one of these droplets, and its height-profile is depicted in Fig. 2. The terrace formation shown in Fig. 1 (phase image) is most probably due to the superposition of lamellae, each one being formed by PS-cylinders disposed parallel to the substrate surface and embedded in the EB matrix. In table 1 we show several height measurements (height image), and their respective number of layers (phase image), carried out in different droplets. The thicknesses showed an integer number of layers, whose average value was at about 32 nm.

Table 1 – height, layers and thickness.

Height of droplet (nm)	Number of layers	Thickness of each layer (nm)
59,2	2	29,6
67,8	2	33,9
68,9	2	34,5
88,7	3	29,6
132,4	4	33,1
150,7	5	30,1
179,7	6	30,0
210,2	7	30,0
217,4	7	31,1
278,6	9	31,0
323,4	10	32,3
371,9	11	33,8
374,4	11	34,0
374,6	11	34,1
	Average	31,9
	Std	1,9

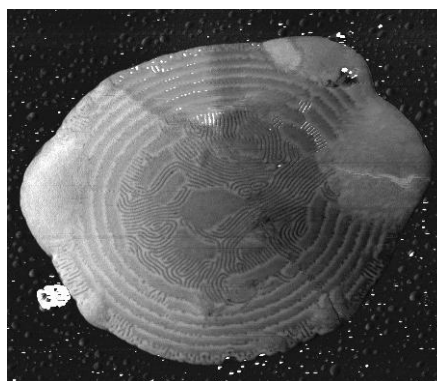


Figure 1 – AFM phase image showing wedding cake like droplet.

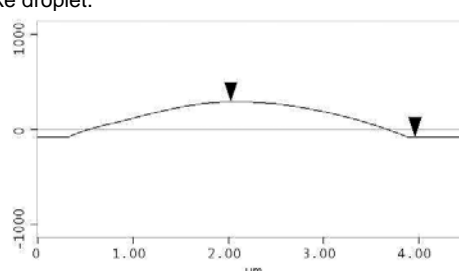


Figure 1 – AFM height profile of figure 1 droplet