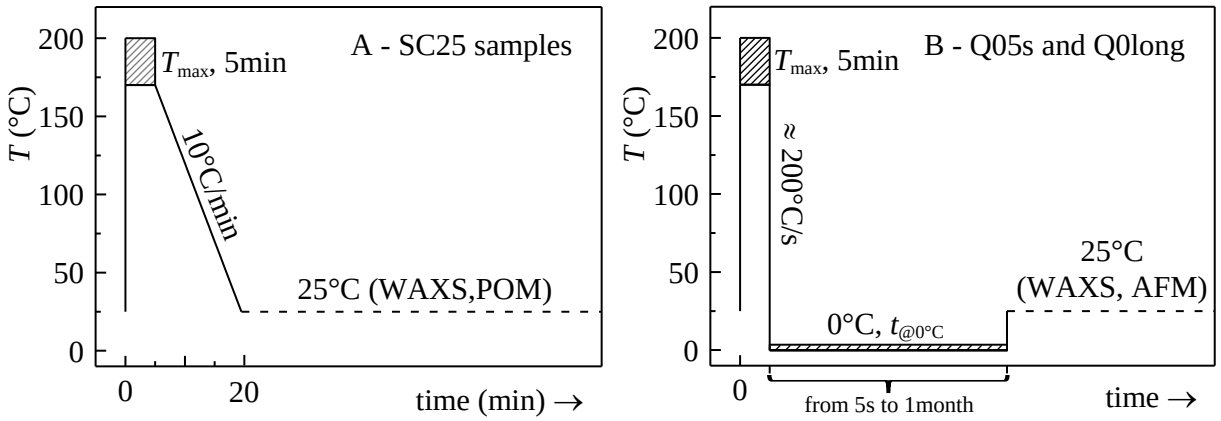
Supporting Information of the paper

Evidence of Nodular Morphology in Syndiotactic Polypropylene from the quenched state

Odda Ruiz de Ballesteros, Fabio De Stefano, Finizia Auriemma, Rocco Di Girolamo, Miriam Scoti, Claudio De Rosa*

Dipartimento di Scienze Chimiche, Università degli Studi di Napoli Federico II, Complesso di Monte S. Angelo, via Cintia 80126 Napoli, Italy

The thermal protocols applied to the sPP samples to obtain the SC25, Q05s and Q0long films to be analyzed by WAXS, POM and AFM are illustrated in the Scheme S1.



Scheme S1. Schematic illustrations of the thermal protocols applied to the sPP samples to get the SC25 (A) and the Q05s and Q0long (B) films.

After melting at T_{max} (ranging from 170°C to 200°C) for 5min to erase the previous thermal history, the sPP samples were cooled at 10°C/min to 25°C to get the SC25 films (Scheme S1A), or fast cooled to 0°C, then kept at 0°C for 5s or for long times to get the Q05s or Q0long films, respectively, (Scheme S1B). These latter after quenching and annealing at 0°C were analyzed at 25°C by WAXS and AFM.

The percentages of crystals in mesomorphic form f_m and in form I f_I, with $f_m + f_I = x_c$, were evaluated from the X-ray diffraction profiles, as shown in Figure S1 for the sample sPP1 quenched from the melt to 0°C and kept at 0°C for 5s, crystallized in mixtures of crystals of the form I and the mesophase.

The X-ray diffraction profile of Figure 1 can be divided in three contributions due to the amorphous phase (A_{am}), the mesophase (A_m) and the crystalline form I (A_I). The contribution of the amorphous phase is given by curve b of Figure S1 and corresponds to the diffraction profile of the atactic polypropylene. Subtracting this amorphous halo (curve b) from the whole diffraction profile of the sample (curve a), the diffraction profile c of Figure 1 is obtained, which represents the contribution to the diffraction of the crystalline phase (A_c), given by the sum of crystals of form I and mesophase ($A_c = A_m + A_I$). The diffraction contribution of the sole mesomorphic form (curve e) is obtained from the diffraction profile of the sample sPP1 crystallized in pure mesomorphic form, obtained by quenching the melt to 0°C and maintaining the sample at 0°C for 8 days (curve a of Figure 2C), after subtraction of the amorphous contribution. The contribution of the sole crystalline form I (curve d) is, then, determined by subtracting curve e, opportunely scaled, from curve c.

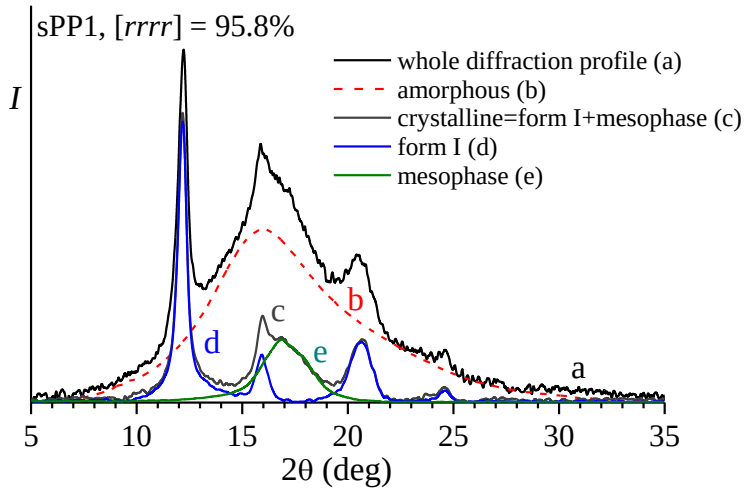


Figure S1. X-ray diffraction profile of the sample sPP1 crystallized in mixtures of form I and mesomorphic form. The whole diffraction profile after subtraction of the background (black curve) is decomposed in the amorphous contribution (red dashed curve b), and in the crystalline contribution (gray curve c) due to the sum of crystals of form I (blue curve d) and mesophase (green curve e).

Table S1. Degrees of crystallinity (x_c) and percentages of crystals in form I (f_I) and in mesomorphic form (f_m) for films of the sPP samples with different stereoregularity, determined from the X-ray diffraction profiles of Figure 1.

		samples SC25			**samples Q05s**			**samples Q0long**		
	[*rrrr*] (%)	x_c (%)	f_I (%)	f_m (%)	x_c (%)	f_I (%)	f_m (%)	x_c (%)	f_I (%)	f_m (%)
sPP1	95.8	47	100	0	31	55	45	32	0	100
sPP2	95.5	43	100	0	33	70	30	29	0	100
sPP3	92.5	44	100	0	33	82	18	32	0	100
sPP4	91.5	41	100	0	27	67	33	31	0	100
sPP5	87.0	39	100	0	32	69	31	32	5	95
sPP6	78.0	37	100	0	30	80	20	34	48	52

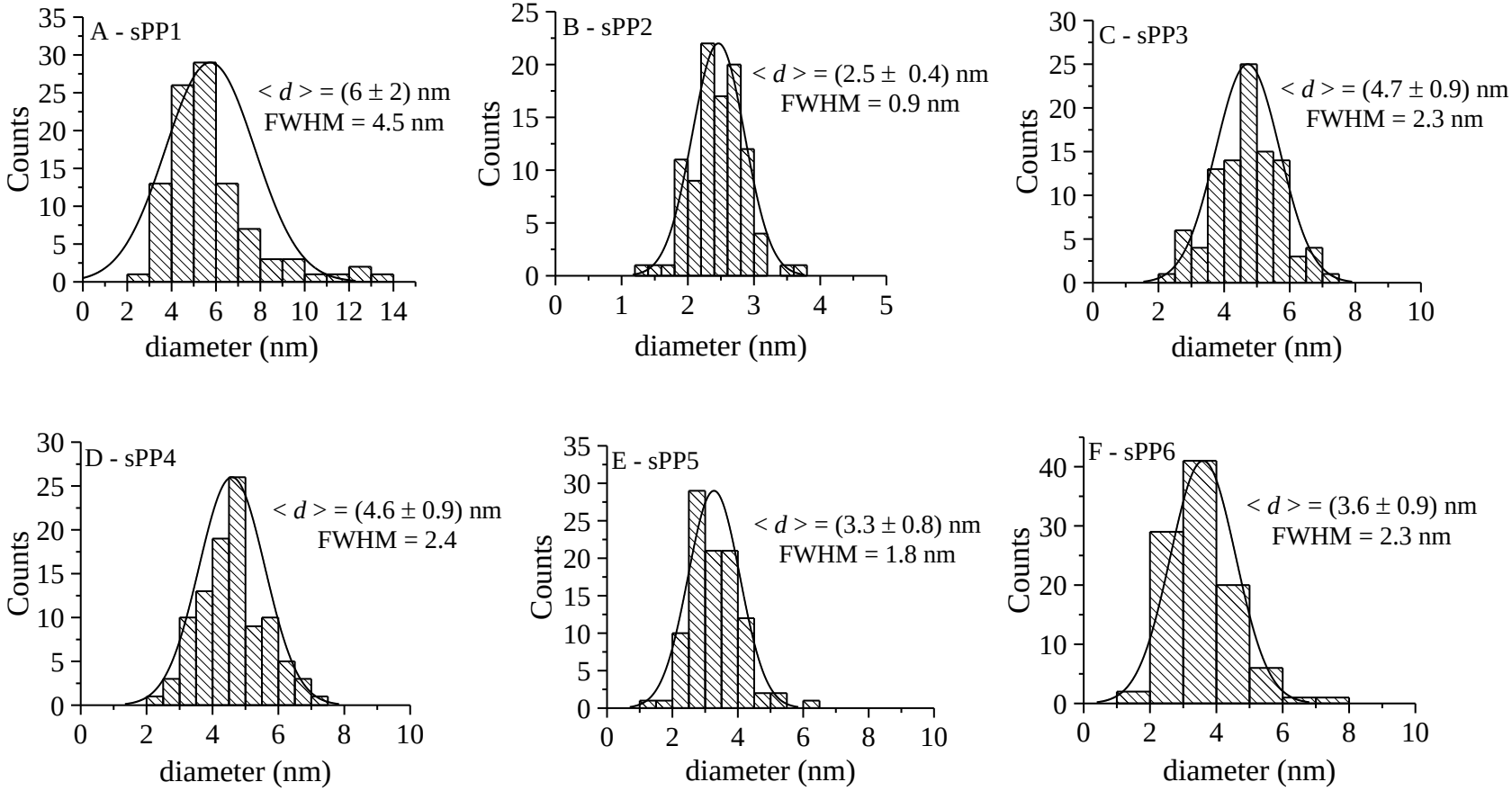


Figure S2. Nodule size distributions fitted by Gaussian curves for the sPP samples Q0long of different stereoregularity, determined from the AFM images of Figure 5 by measuring the diameter of at least 100 particles. The means (average diameters < *d* >), the standard deviations and the full widths at half maximum (FWHM) of the distributions are indicated.

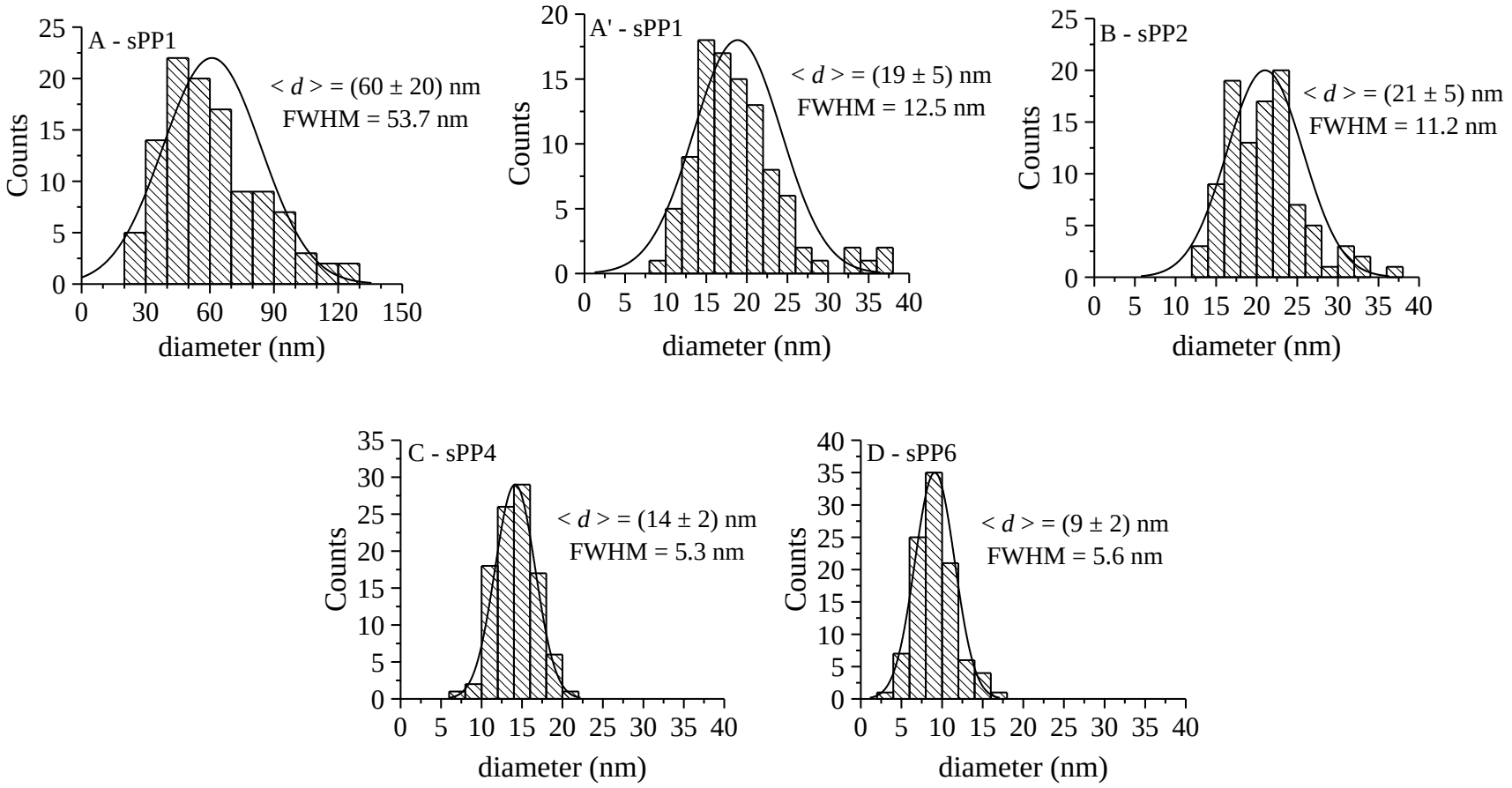


Figure S3. Nodule size distributions fitted by Gaussian curves for the sPP samples Q05s of different stereoregularity, determined from the AFM images of Figure 6 by measuring the diameter of at least 100 particles. The means (average diameters < *d* >), the standard deviations and the full widths at half maximum (FWHM) of the distributions are indicated.