



Preliminary study on continuous compounding of PA6/PP using a continuous micro-lab compounding line

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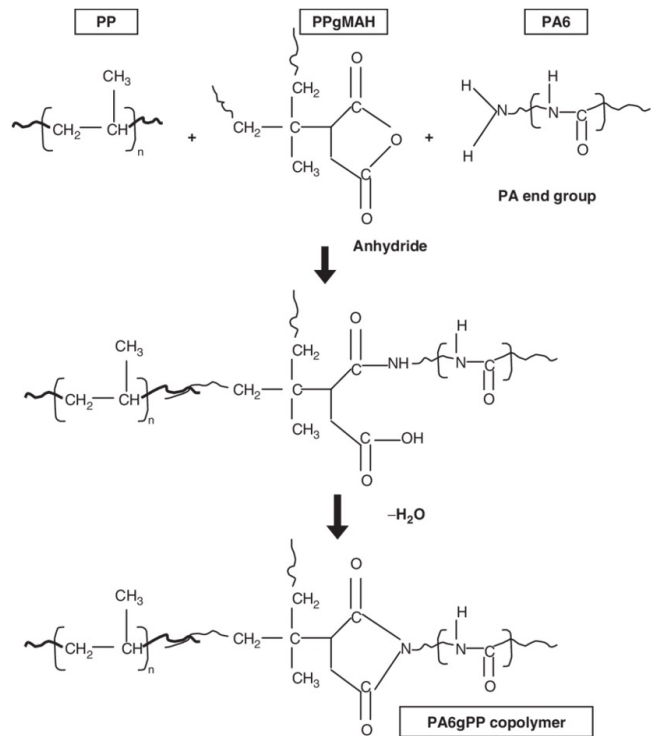
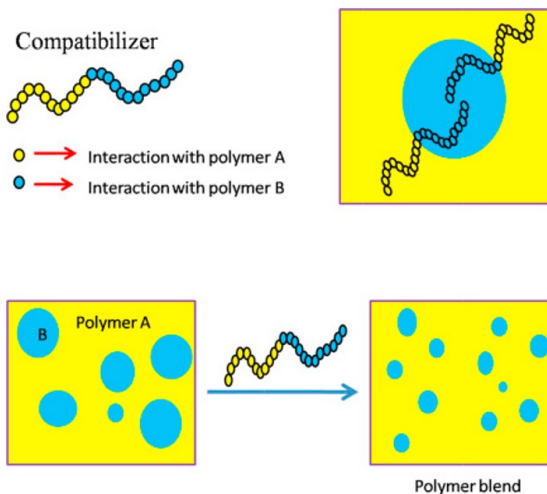
An MC 15 HT is a standard instrument in polymer R&D, known as its well-mixing capacity in recirculation mode (batch mode). An MC 40 is a rheo-copy of the existing MC 15 HT, having similar mixing character with lower shear intensity due to lower torque/cm³.

But both them are known to be "BATCH COMPOUNDERS" By the manufacturing of the water-bath/pelletizer add-ons, now it is possible to perform small-scale (lower than 1 kg/h) polymer compounding using MC40 in cont. mode.

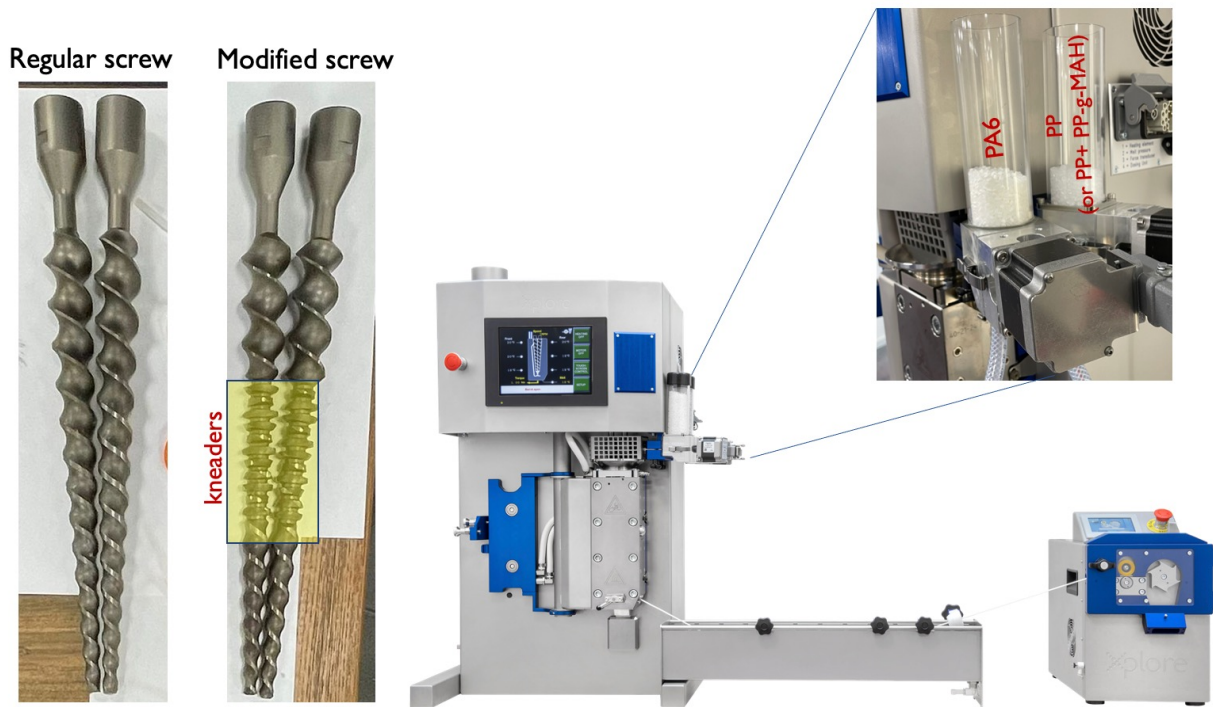
In order to get the first impression of the quality of the mixing, as a starting point, the well-known PP/PA6 blends were compounded at different processing conditions using two types of screws. The initial indicative data has been compared with the batch compounding.

Background

PP/PP-g-MAH/PA6 Interface Reaction



Experimental Approach



Constant PA6/PP Ratio: 30/70 (by weight)
 Compatibilized (2% PP-g-MAH) or
 Uncompatibilized
 Screw Speed: 50 / 100 / 200 rpm
 Control: MCI5HT/100 rpm/3 min

PP/PA6 Blends (80/20)		
Comp. Content (%)	Screw Speed (RPM)	Screw Type
0	50	Regular
3	100	Modified
	200	

Results

		PP/PA6 Blends (70/30) PA6 Phase etched-out (black holes)				
		Ss: 50 rpm		SS: 100 rpm		Ss: 200 rpm
		<u>Uncomp.</u>	Comp.	<u>Uncomp.</u>	Comp.	Comp.
Cont. Compounding MC40	Regular					
	Modified					
Batch Compounding MCI5 HT	Regular					

Results (cont'd)

		PA6 Phase Size (microns)				
		Ss: 50 rpm		SS: 100 rpm		Ss: 200 rpm
		<u>Uncomp.</u>	<u>Comp.</u>	<u>Uncomp.</u>	<u>Comp.</u>	<u>Comp.</u>
Cont. Compounding MC40	Regular	Coarse (>50 mic) unround, elongated	Avg: 14,4 mic Round, well distributed	Avg: 3,8 mic A mixture of elongated and round particles, well distributed	Avg: 2,1 mic Round particles, well distributed	Avg: 2,8 mic Round particles, well distributed
	Modified	Coarse (>50 mic) unround, elongated	Avg: 10,1 mic Round, well distributed	Avg: 2,2 mic Mostly round particles, well distributed	Avg: 0,9 mic Round particles, well distributed (presence of sub mic. particles)	Avg: 1.4 mic Round particles, well distributed
Batch Compounding MC15 HT*	Regular			Avg: 1,8 mic A mixture of larger elongated and smaller round particles, well distributed	Avg: 1.4 mic Round particles, well distributed	

* 3 min, 100 rpm, regular screw in recirculation mode

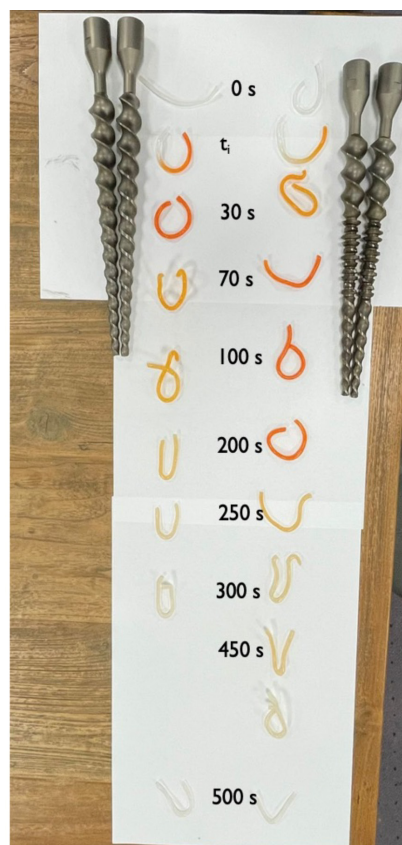
Residence time distribution

Colour-masterbatch test:

- Feed Rate: 7.3 g/min (0.4 kg/hr)
- Screw Speed: 100 rpm
- Barrel temperature: 210°C
- MFI: 0.2 g/10min (Sabic-2100)

	Regular screw	Modified screw
t_i (s)	14	46
t_f (s)	360	480

Residence time distributions are different.
The modified screw has broader residence time distribution compared to regular one.



The residence time and residence time distribution of modified screws are higher than that of unmodified.

Promising results were obtained using modified MC 40 screws. The PA6 domain size gets smaller when the modified screw were used.

In compatibilized blends, the MC15 HT and cont-MC 40 with modified screws yielded similar properties



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