

Technical Information

Visualization Method for Analysis of Polymer Behavior in TEX

Developed to remarkably improve productivity of powder material

1. Outline

We have a significant number of requests from our customers for a real-time grasp of polymer behavior inside extruders during operation. There have been two conventional methods to try to uncover the “black box”; the screw extracting method by pulling out screws and the clamshell cylinder method by opening the two-piece cylinder to take out screws. However, both methods require instant shut down and rapid cooling of the cylinders to cool down melting polymer for analysis. Therefore, the actual polymer behavior can not be correctly observed.

We report here our latest flow visualization method for analysis of polymer behavior inside twin screw extruder TEX. The special cylinder with sight glass window enables us to directly observe the dynamic mixing condition during extrusion.

2. The special cylinder for flow visualization

Heat-resistant glass is installed to the side of cylinder and we can observe polymer behavior through it in real time. And the cylinder has sensor holes so as to measure polymer temperature and pressure at the same time of the polymer behavior observation. We can achieve examination with higher accuracy than conventional methods in combination of real-time observation and polymer temperature/pressure data.

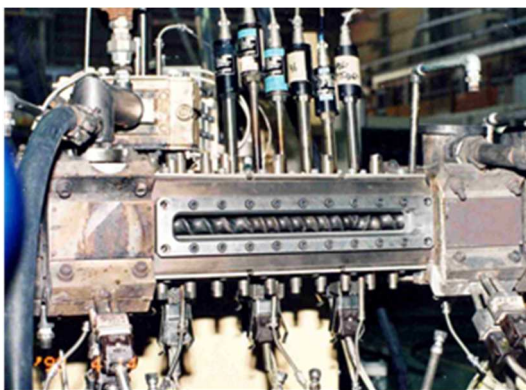


Photo 1. Special Cylinder with Sight Glass

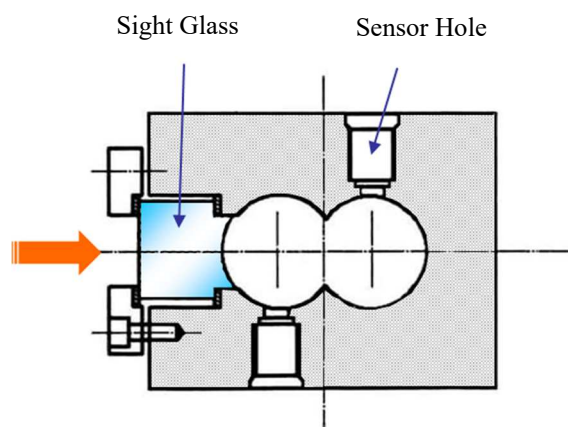


Fig 1. Cylinder Structure for Flow Visualization

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3. Observation result

The following figures show the mixing flow process with different kinds of screw configurations using a red masterbatch tracer blended into PP powder. FK and FR+RR screws have a similar melting performance, but CK screw has an earlier melting start. Polymer temperature data also show the same tendency that it is higher with CK screw. Polymer pressure is the highest with FR+RR screw.

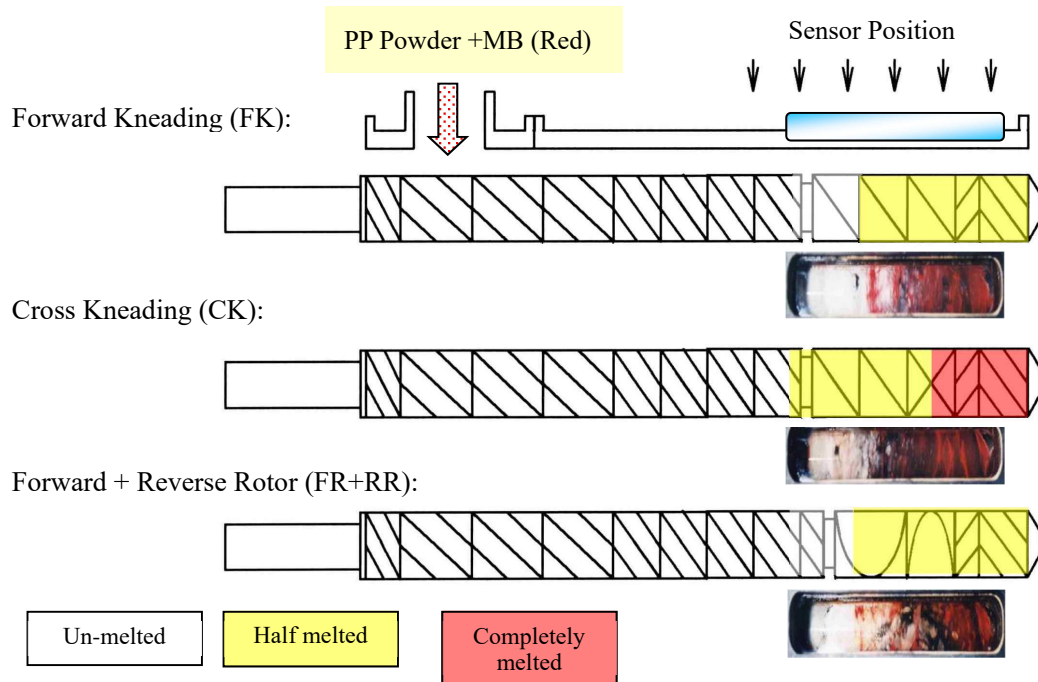


Fig. 2 Observation Results

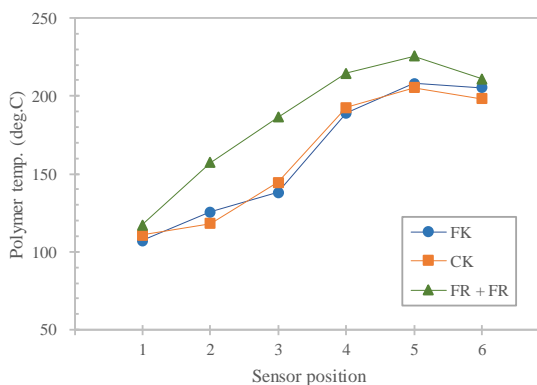


Fig. 3 Polymer Temperature

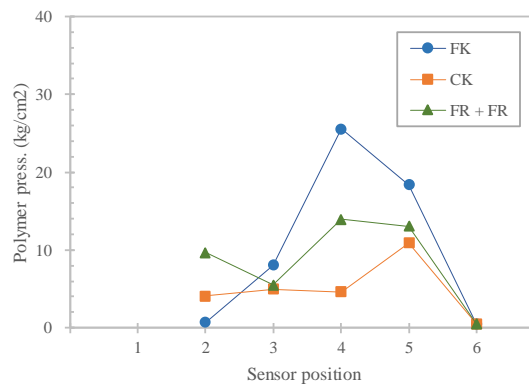


Fig. 4 Polymer Pressure

*Q = 50 kg/h, Ns = 250 rpm, PP powder (MFR = 1.0), Cyl. Set temp. = 230 deg.C

4. Afterword

We believe that this visualization method is beneficial for the real-time analysis of mixing mechanism in black box of extruder with further improvement of analysis accuracy. Please contact us any time if you are interested in our technique.