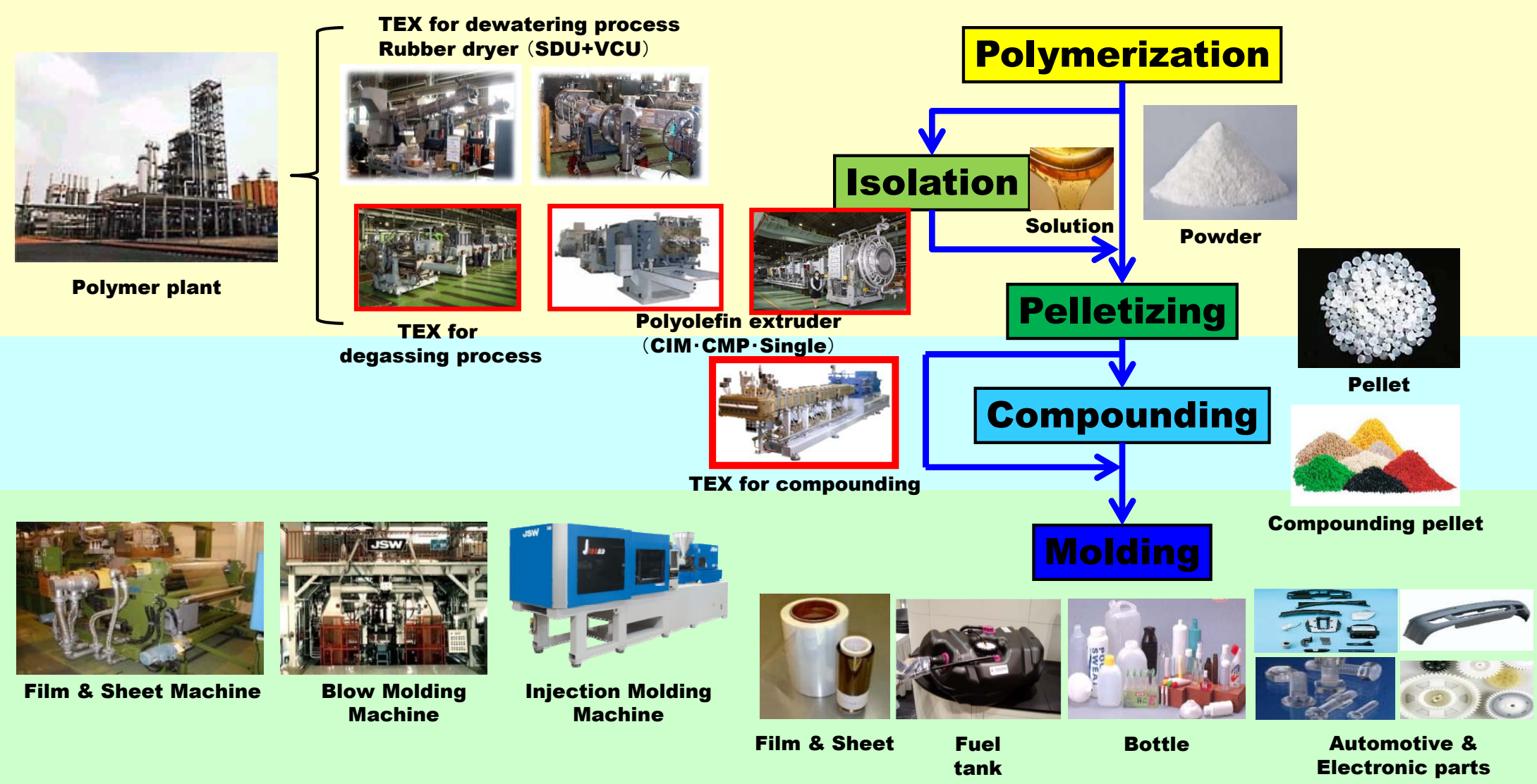
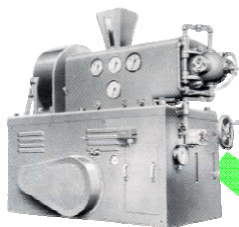


Twin Screw Extruder “TEX” in a Wide Variety of New Processes

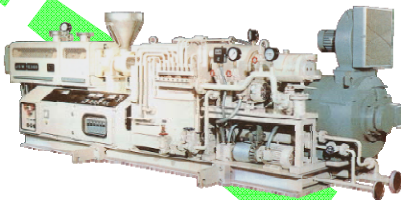
**Paul O. Martin
Vice President
JSW America Inc.**

- ❑ Introduction
- ❑ Batch Mixer / Paddle Type Blender: For low viscosity materials
- ❑ Batch Mixer / Banbury Mixer: For high viscosity materials
- ❑ Continuous mixer: Twin Screw Extruder, TEX
 - Example of changing process from batch process to twin screw extrusion process; Devolatilization process for specialty purpose additives
 - Example ABS+SAN compounding
 - Example: Compounding of plant derived material
- ❑ Conclusion





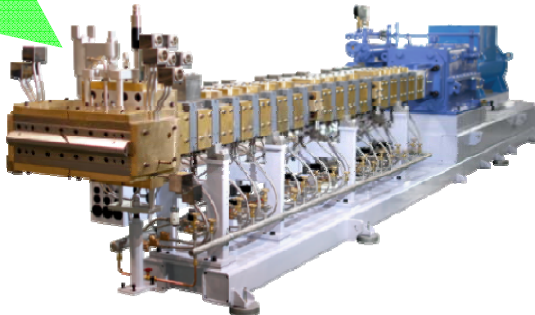
1950
First single screw extruder



1978
First twin screw extruder
TEX65

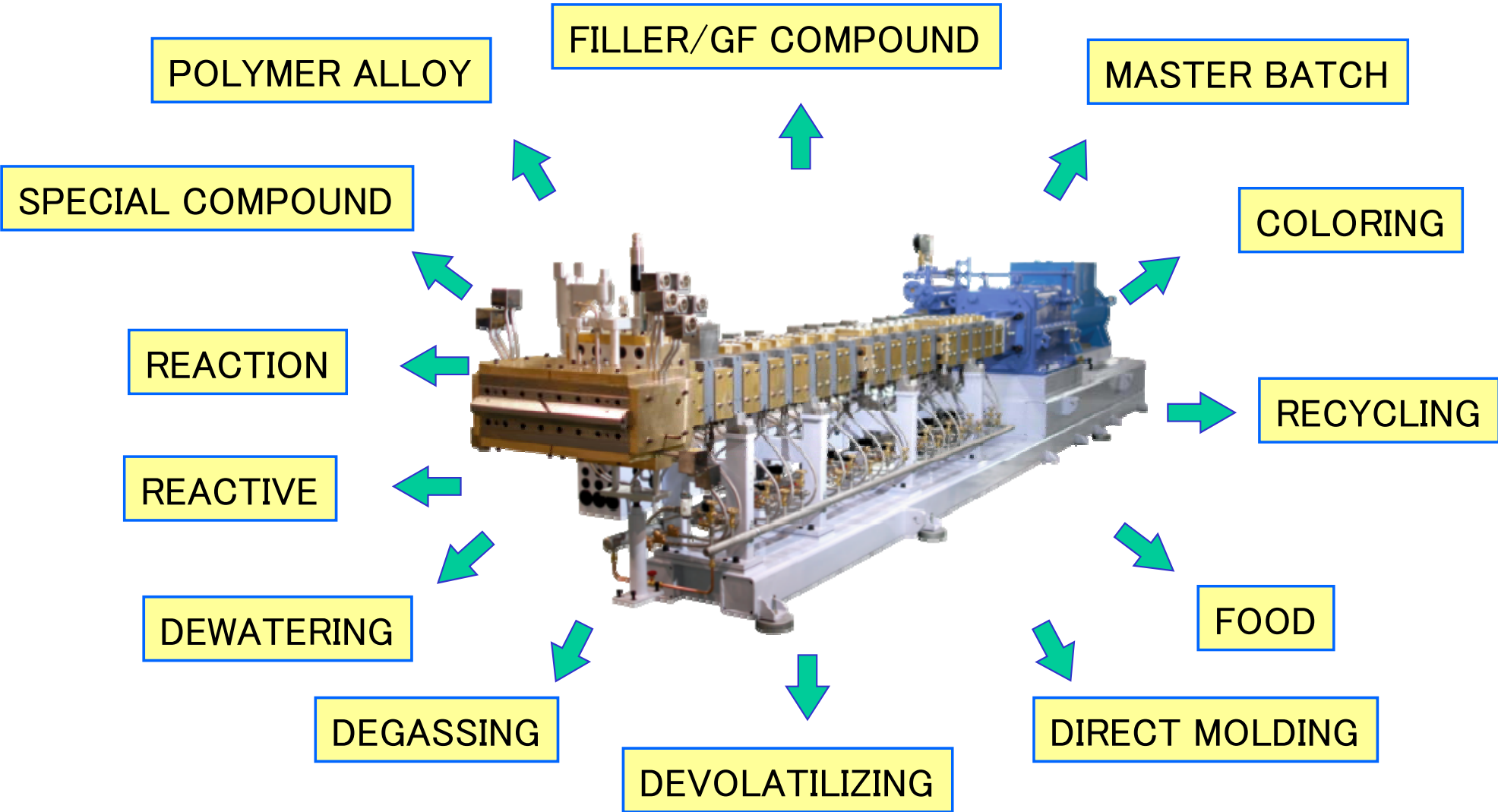


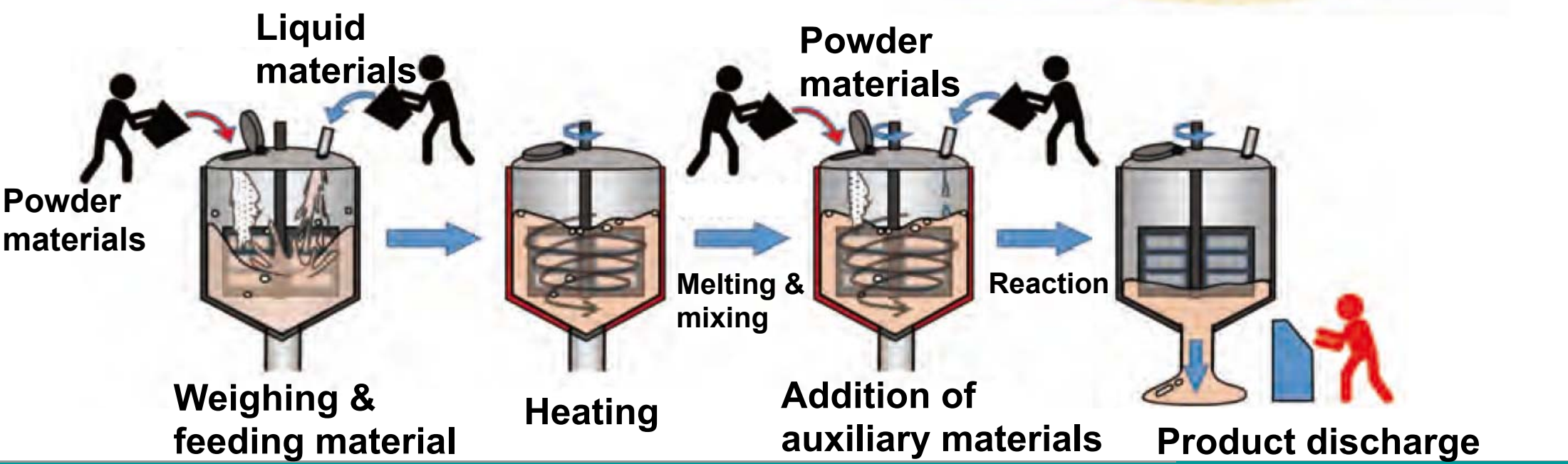
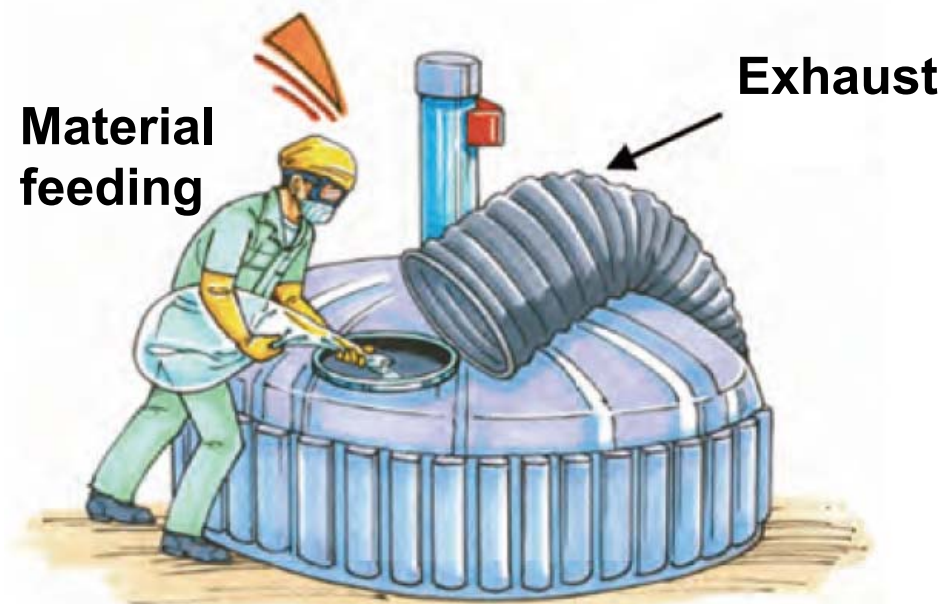
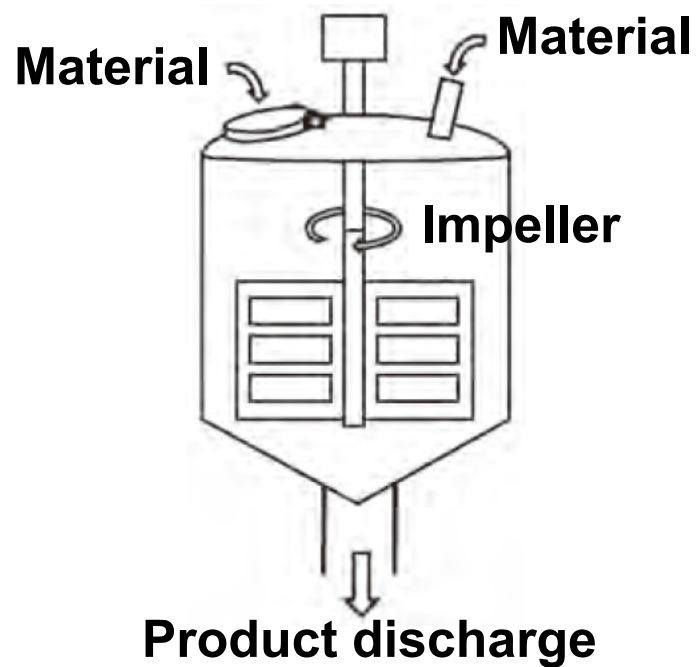
2004
World largest size Twin Screw
Extruder TEX400α



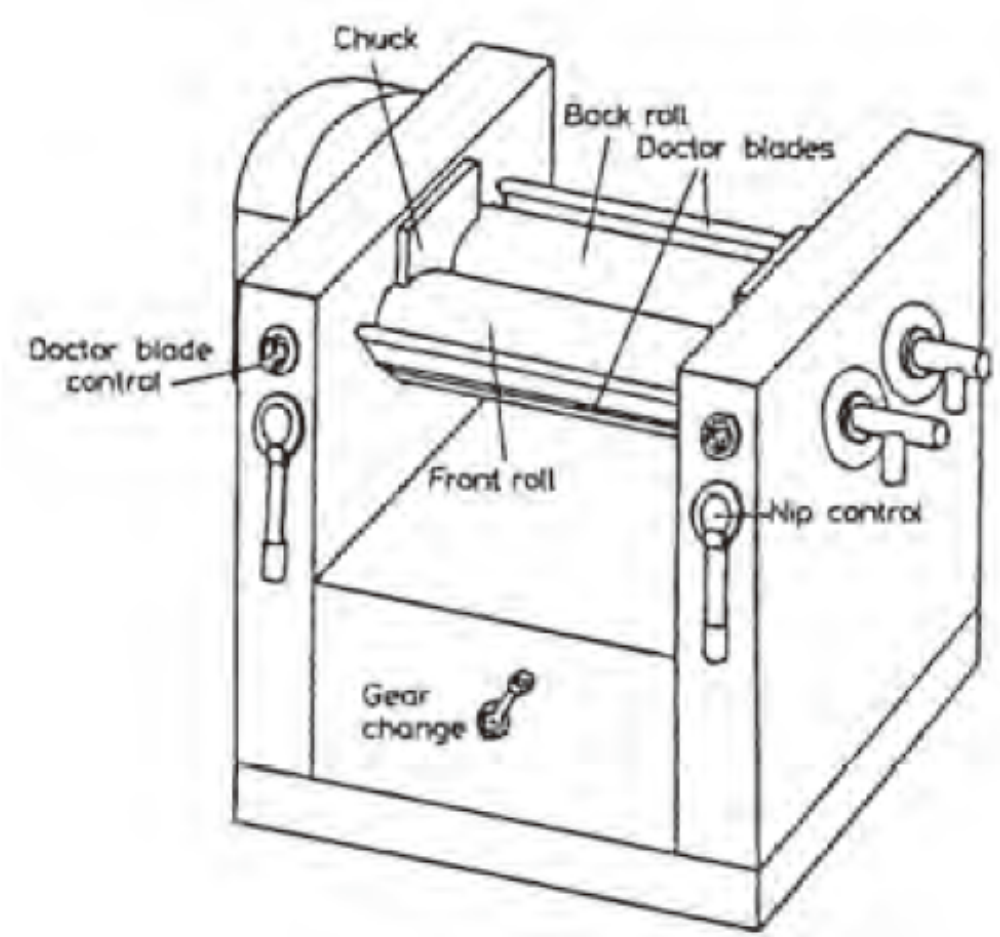
2011
New Generation TEXαIII
series

TEX : **T**win Screw **EX**truder

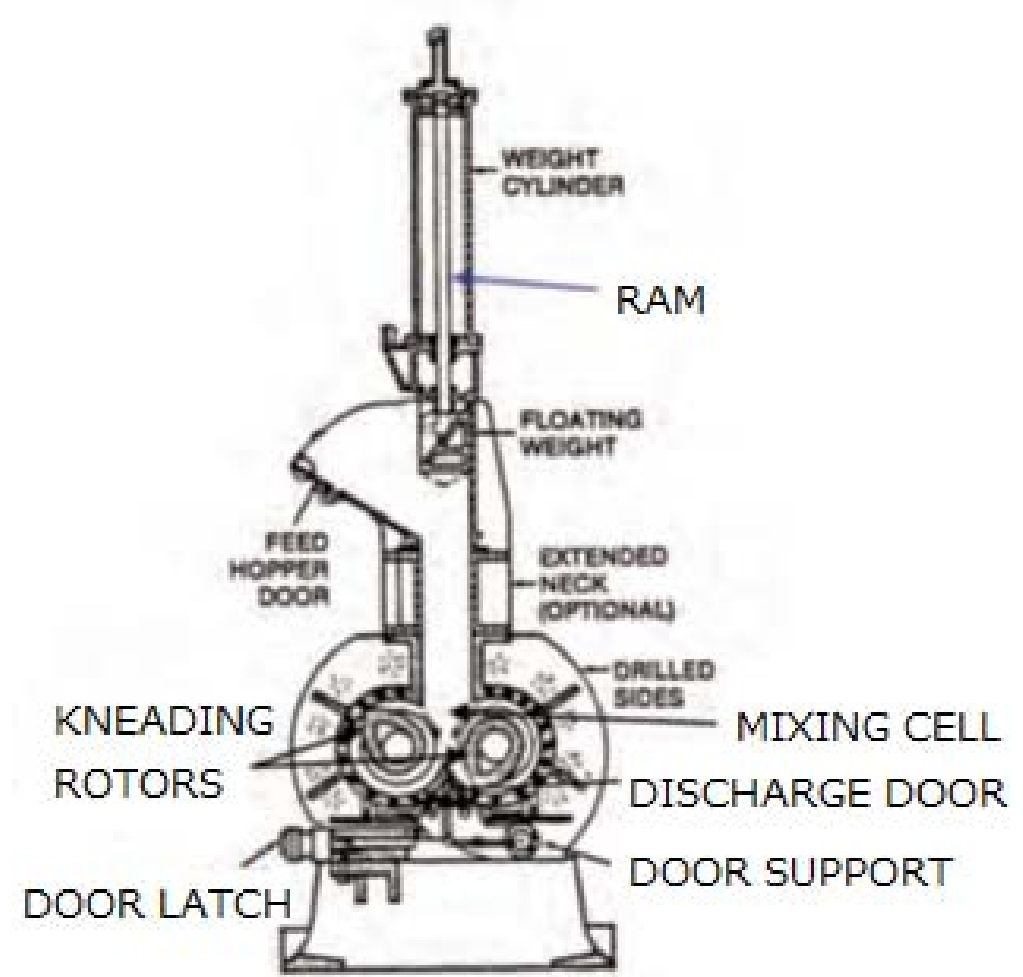




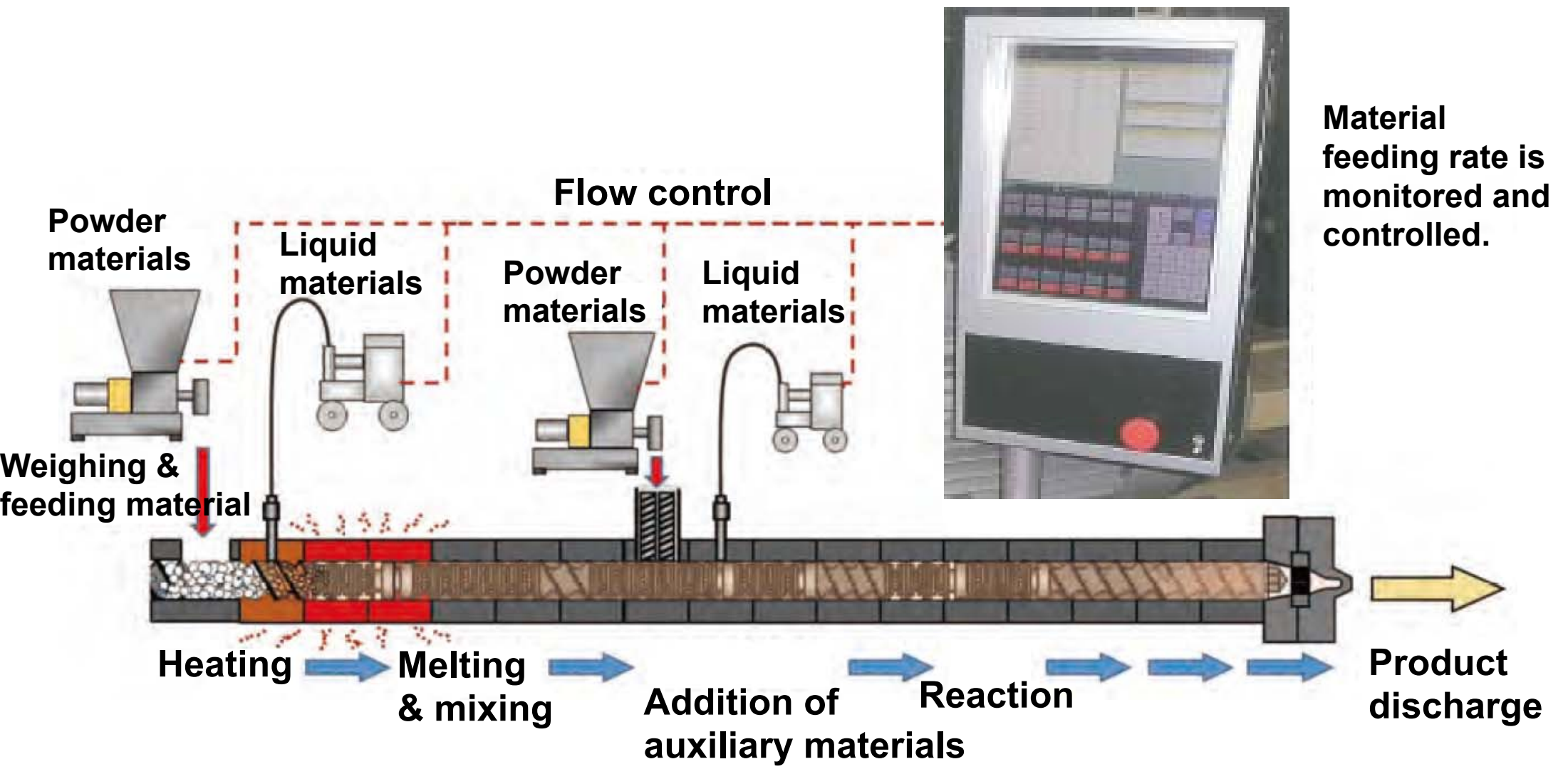
Twin roll mill



Banbury mixer



Centralized control by controller



Paddle type
blender



Pressurization
kneader



Twin Screw
Extruder

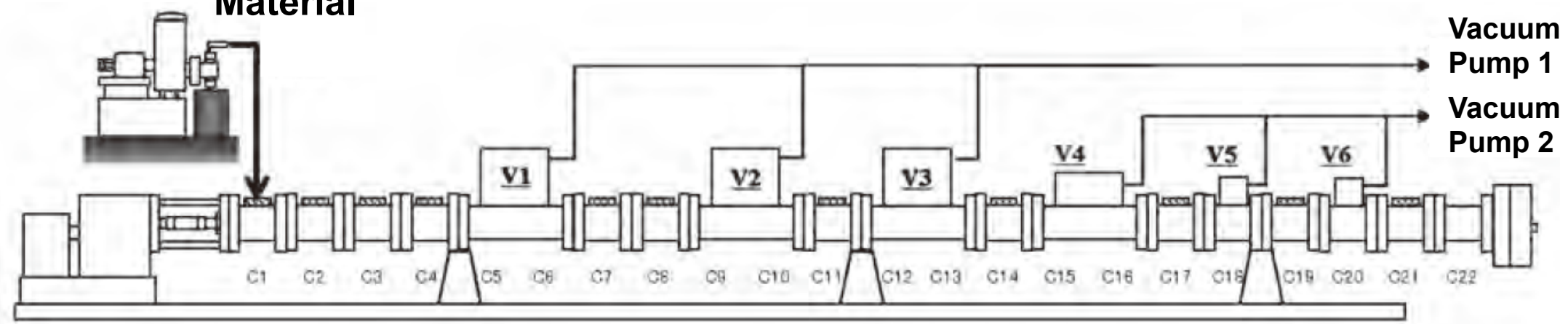


Low viscosity materials 50mPa·s(cP)	◎ Good mixing thanks to disturbed flow turbulence and more flexibility on blending time.	X Operation is possible but poor mixing efficiency due to low speed.	△ Good disturbed flow turbulence can be obtained but relatively shorter residence time.
Medium viscosity materials 10mPa·s(10,000cP)	△ Possible contamination of some materials. Possible difficulty of discharge.	△ Discharge difficulty for adhesive materials.	◎ Good mixing can be possible. Thanks to self-cleaning feature, there will be no contamination of materials.
High viscosity materials 10kPa·s(10^6cP)	X Not possible to handle due to lack of torque and strength.	◎ Good mixing thanks to high torque and more flexibility on blending time.	◎ Good mixing thanks to high torque. Flexibility of blending is depending on L/D.
Solid materials	X Not possible to handle due to lack of torque and strength.	◎ Plasticizing and melting of solid material can be possible with high torque.	◎ Plasticizing and melting of solid material can be possible with high torque.

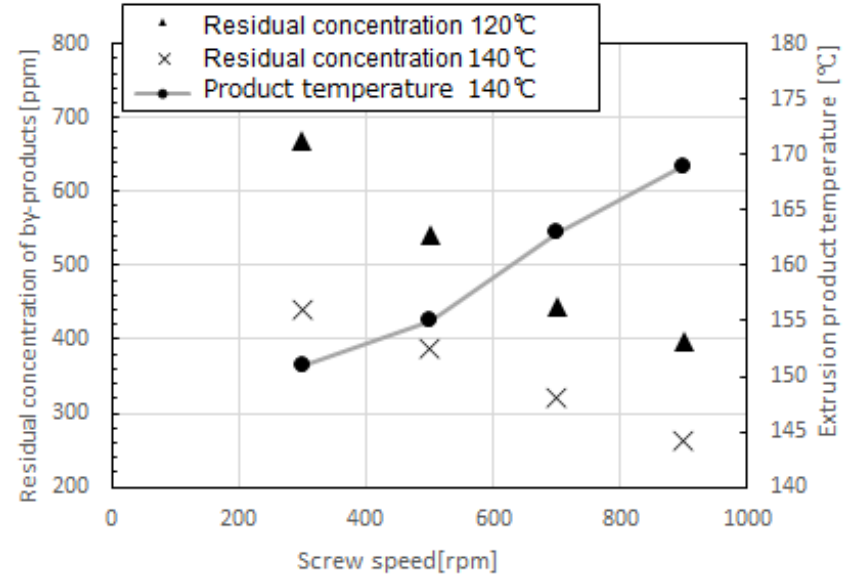
LEGEND: ◎= Excellent, △= Fair, X= Poor

Devolatilization process for specialty purpose additives

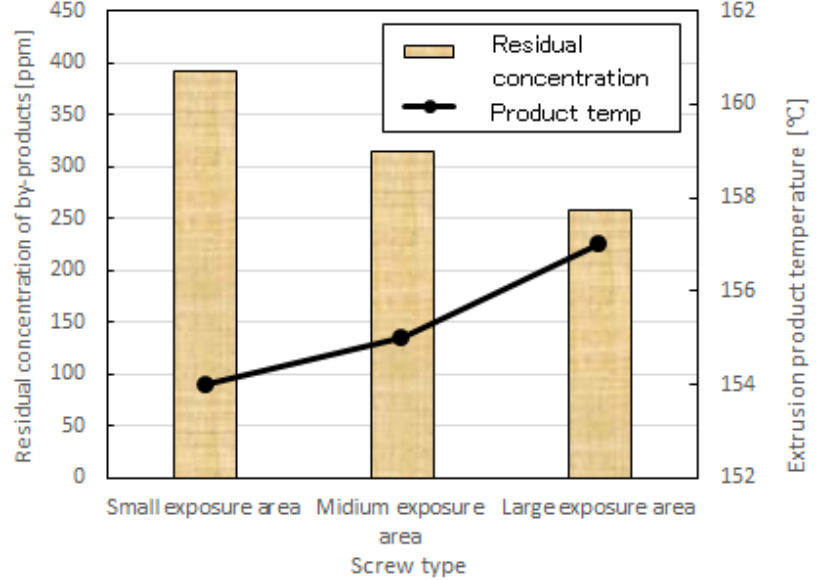
Material



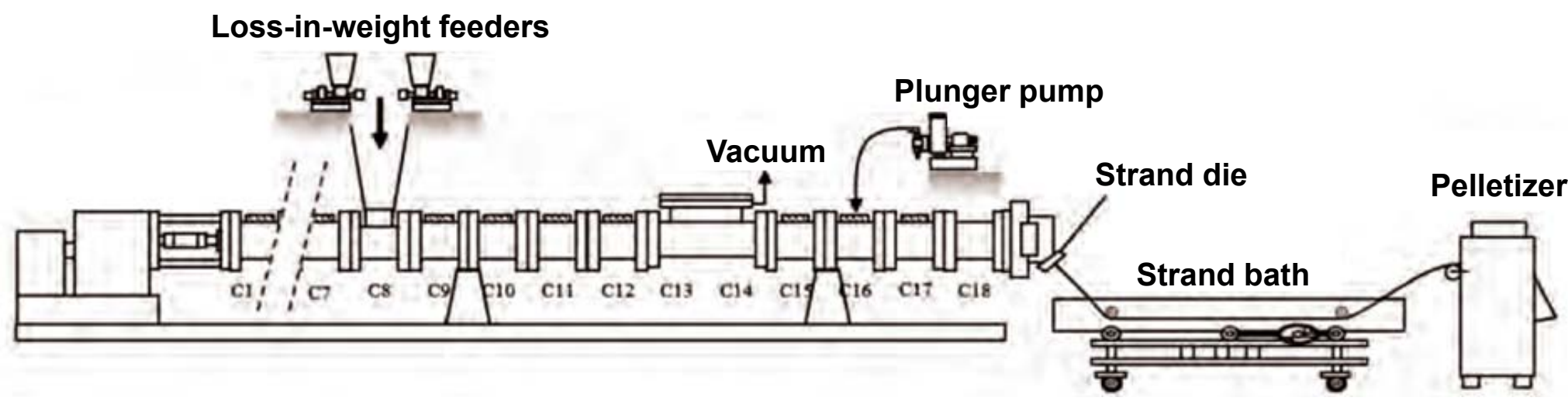
Relationship between screw rpm and residual concentration of by-products



Relationship between screw configuration and residual concentration of by-products



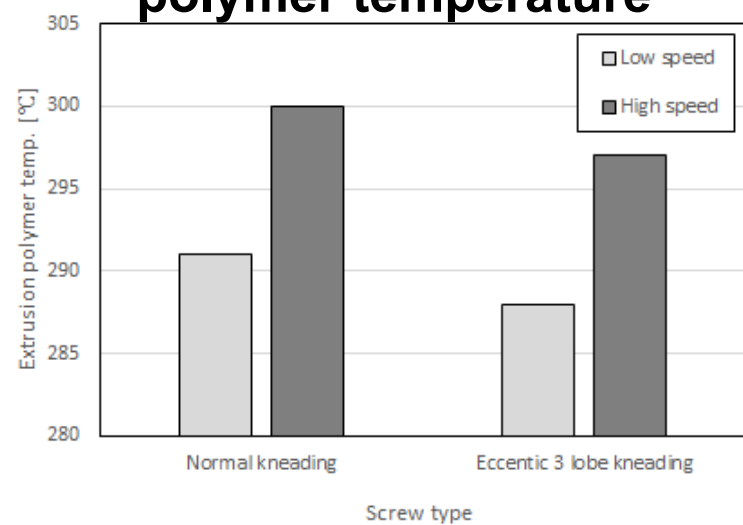
ABS+SAN compounding



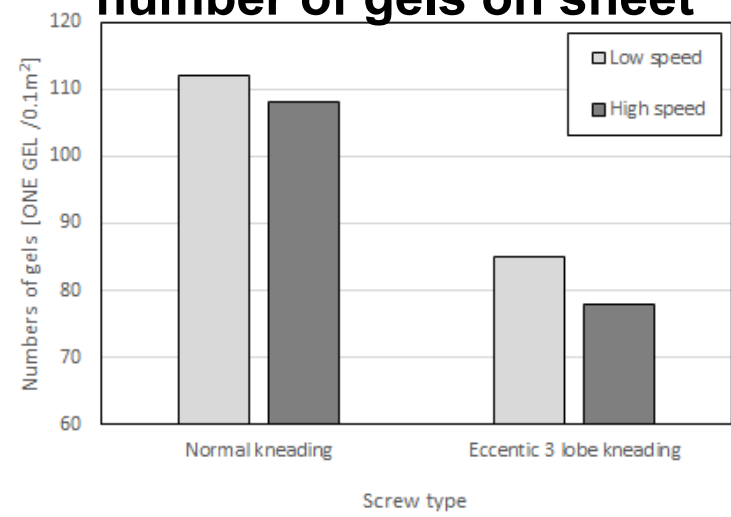
Eccentric 3 lobe kneading elements



Relationship between screw configuration and polymer temperature



Relationship between screw configuration and number of gels on sheet

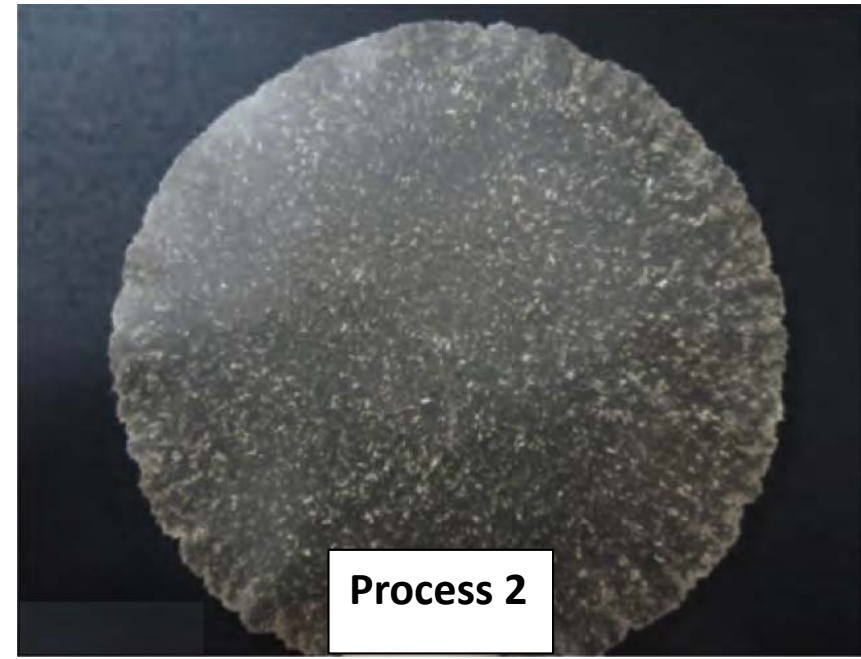
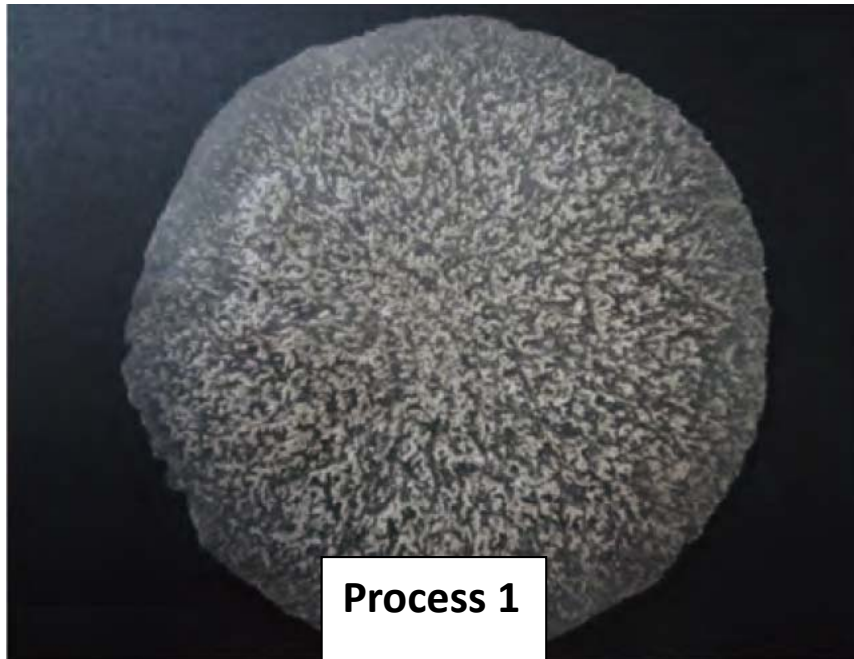
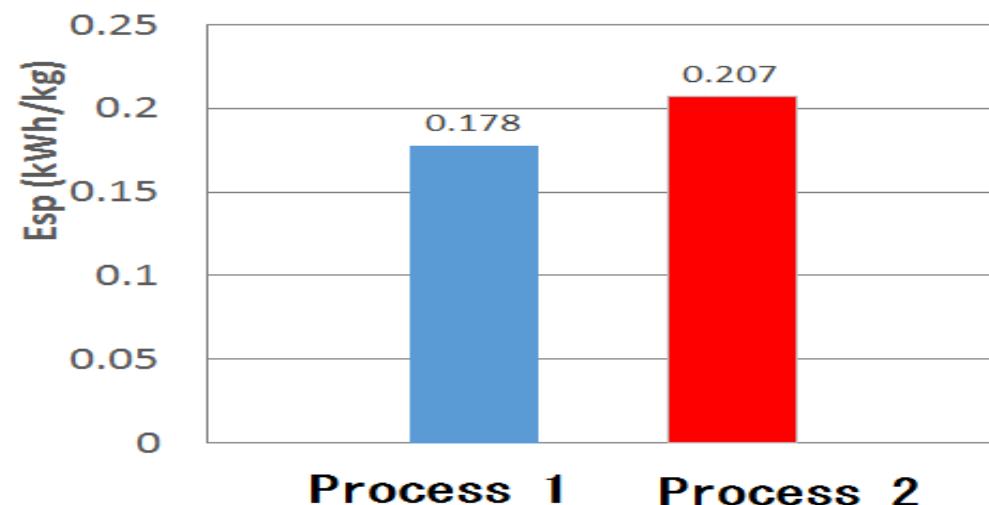


Process 2 : Crushing fibers into small pieces and melt with olefin

Fiber Polymer



ABS+SAN compounding

**Experimental conditions****Extruder : TEX30 α** **Barrel L/D : 52.5****Throughput : 15kg/hr****Screw speed : 200rpm****Barrel temperature : 100~180°C****Content of fiber : 30wt%****Comparison of Specific energy**

Twin Screw Extruders (TSE)

- ✓ Made achievement on high torque, high speed equipment
- ✓ Continuous research and development
- ✓ Still more potential usability for various applications where TSEs are traditionally not used.
- ✓ Productivity conscious and HSE conscious
- ✓ Committed for further improvement and upgrading of Twin Screw Extruder technologies.

Thank you for your attention

References

- 1) Sumida, Tomomitsu, Saga, Tojyo, Shimizu, Kodate, Ishibashi, Kakizaki, Inoue JSW Technical Report Vol. 64 (2013)
- 2) Ministry of Health, Labor and Welfare of Japan Workplace Safety, anzeninfo.mhlw.go.jp/
- 3) Kimimasa Ito: Compounding (1993)
- 4) “Devolatilization of Plastics”, VD-VERLAG BmbH (1980), p16
- 5) Dr. Sunghoon Kim, Dr. Costas G. Gogos: Polymer Mixing Study Polymer processing Institute (1998), p102