Crystallization Behavior of Polypropylene under Pressure and shear flow

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[Objectives]

To investigative effects of the steady shear flow and presure on the crystallization of polypropylene.

[Sample]

i-PP(Chisso Petrochemical Corp.)
Mw=225,000
Mw/Mn=4.48

[Under High Pressure and Shear(PVT measurement system)]

[Apparatus]

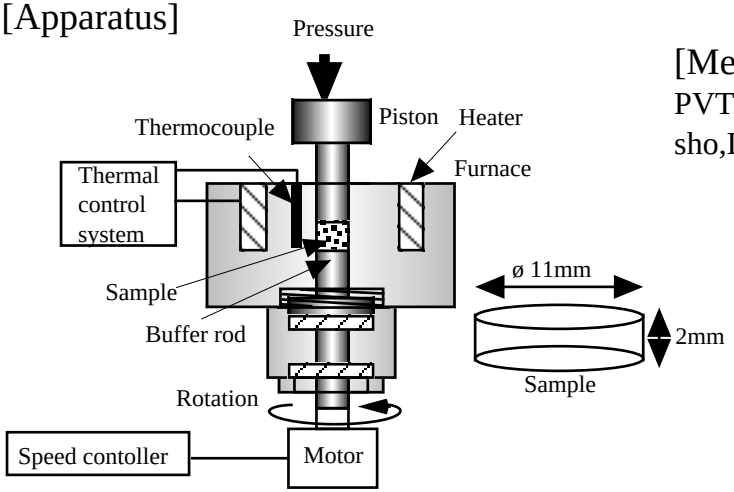

Fig. 1 Schematic diagram of the SF-PVT

[Measurement system]

PVT TEST SYSTEM (Toyo Seisaku-sho,Ltd.)+Shear Flow cell (SF-PVT)

[Measurement]

Temperature (˚C)	140, 145, 150
Pressure (MPa)	5, 10, 15, 20
Shear rate (s^{-1})	0, 0.1, 0.2, 0.5

[Results]

- Relative crystallinity

$$X(t) = (v_0 - v(t))/(v_0 - v_\infty)$$

v_0:specific volume(t=0)
$v(t)$:specific volume(t)
v_∞:specific volume(t=∞)

- Avrami equation

$$X(t)=1-\exp(-ktn)$$

$$1/t_{1/2} = (\ln 2/k)n$$

k :crystal rate constant
n:Avrami exponent
$t_{1/2}$:crystallization half-time

"Crystallization rate" $1/t_{1/2}$

- Hoffman-Lauritzen equation

$$G=G_0\exp(-U^*/RT_c)\exp(-Kg/T_c\Delta T)$$

$$Kg=2b\sigma\sigma_e T_m^{\ 0}/\Delta H_f K$$

ΔH_f:heat of fusion
σ:lateral surface free energy
σ_e:fold surface free energy
b:distance between two adjacent