MINIFIBERS, INC.

Fybrel® Fibrillated Synthetic Fibers for Vinyon Replacement

I. BACKGROUND

Vinyon is made from a copolymer based on 85% vinyl chloride and 15% vinyl acetate, and has been used as a heat-sealable fiber for the tea bag industry. Two types of fibrillated fiber based on polyolefin polymers have been developed for the replacement of vinyon fiber.

II. FIBER PROPERTIES

Properties	Comparison		
	E-type	UL-type	Vinyon
Density (g/cm^3)	0.96	0.93	1.30
Melt Flow Rate (g/10min)	28	8	-
Average Fiber Length (mm)	0.8	1.1	5
Drainage Factor (sec/g)	0.3	1.5	0.1

III. THERMAL PROPERTIES

Properties		Comparison (see Figures 1-3)		
		E-type	UL-type	Vinyon
Glass Transition Temperature	(Tg)	-	-	73oC
Crystalizing Temperature	(Tc)	117oC	112oC	-
Melting Point	(Tm1)	133	116	-
	(Tm2)	-	125	-

III. HEAT SEAL STRENGTH

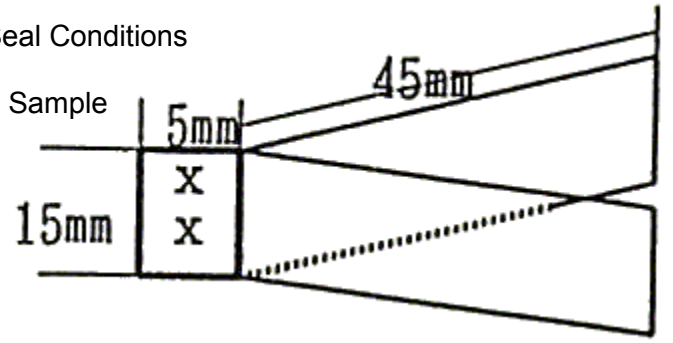
A. Sample Preparation

1. Composition
   100% synthetic fiber: $4g/m^2$
   Tea bag paper: $12g/m^2$

2. Pre-Treatment
   The samples were heated at 190°C for 60 seconds.

B. Heat Seal Conditions

1. Sample



x heat seal part

2. Heat Seal Temperature
   Upper Bar/Lower Bar = 140°C/140°C and 200°C/200°C

3. Heat Seal Pressure = 1 kg/cm^2

4. Heat Seal Time = 0.5 seconds

C. Measurement of Heat Seal Strength

a. Temperature at Measuring = 23°C

b. Number of Samples(n) = 5

Heat Seal Temperature	**Heat Seal Strength - g/15mm (see Figure 4)**		
	E-type	UL-type	Vinyon
70~120°C	Not sealable	Not sealable	Not sealable
140°C	29	113	37
200°C	190	165	113

Fig. 1 VR-A

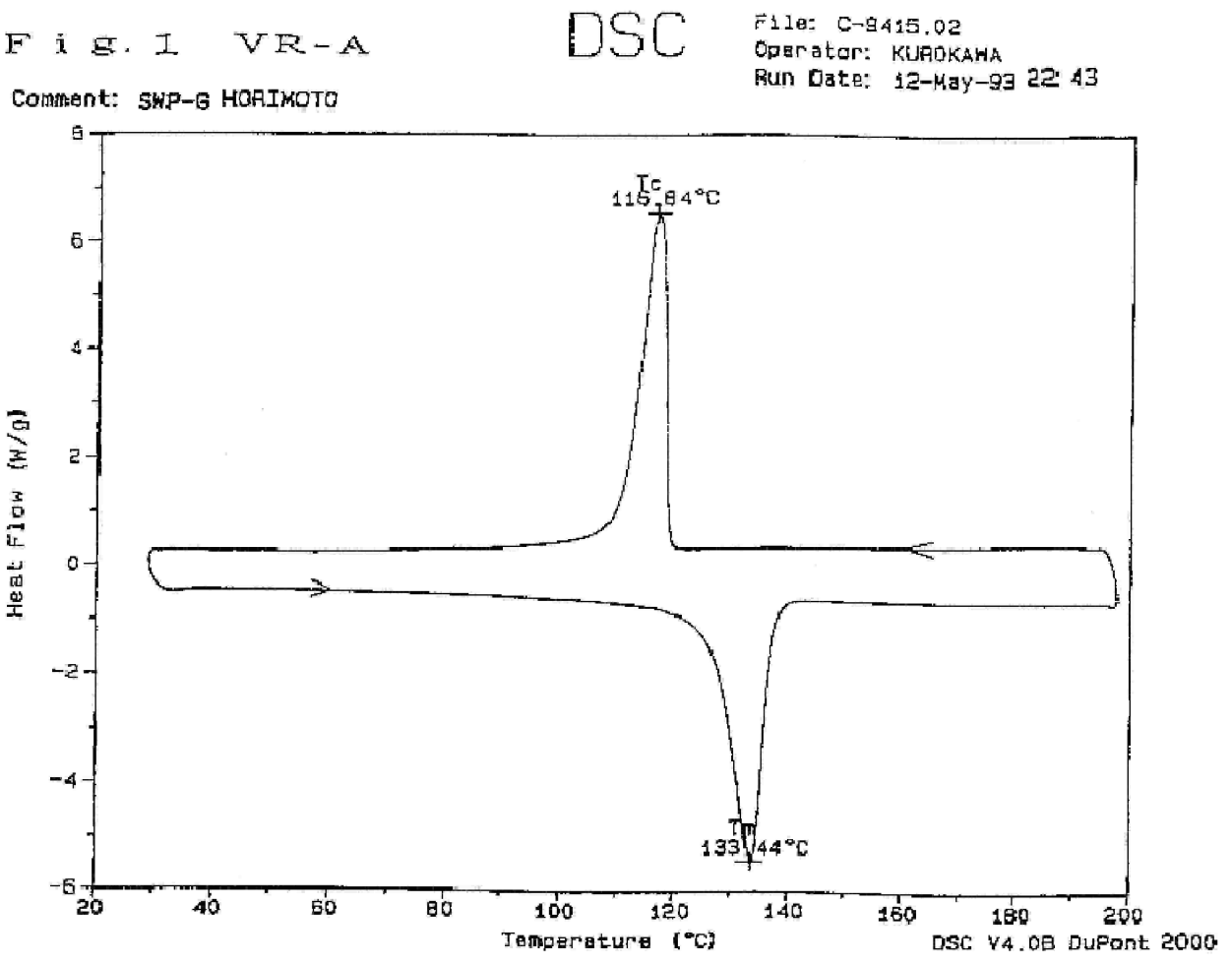

DSC
File: C-9415.02
Operator: KUROKAWA
Run Date: 12-May-99 22:43
Comment: SWP-6 HORIMOTO
Tc
115.84°C
Tm
133.44°C
Heat Flow (W/g)
Temperature (°C)
DSC V4.0B DuPont 2000

Fig. 2 VR-B

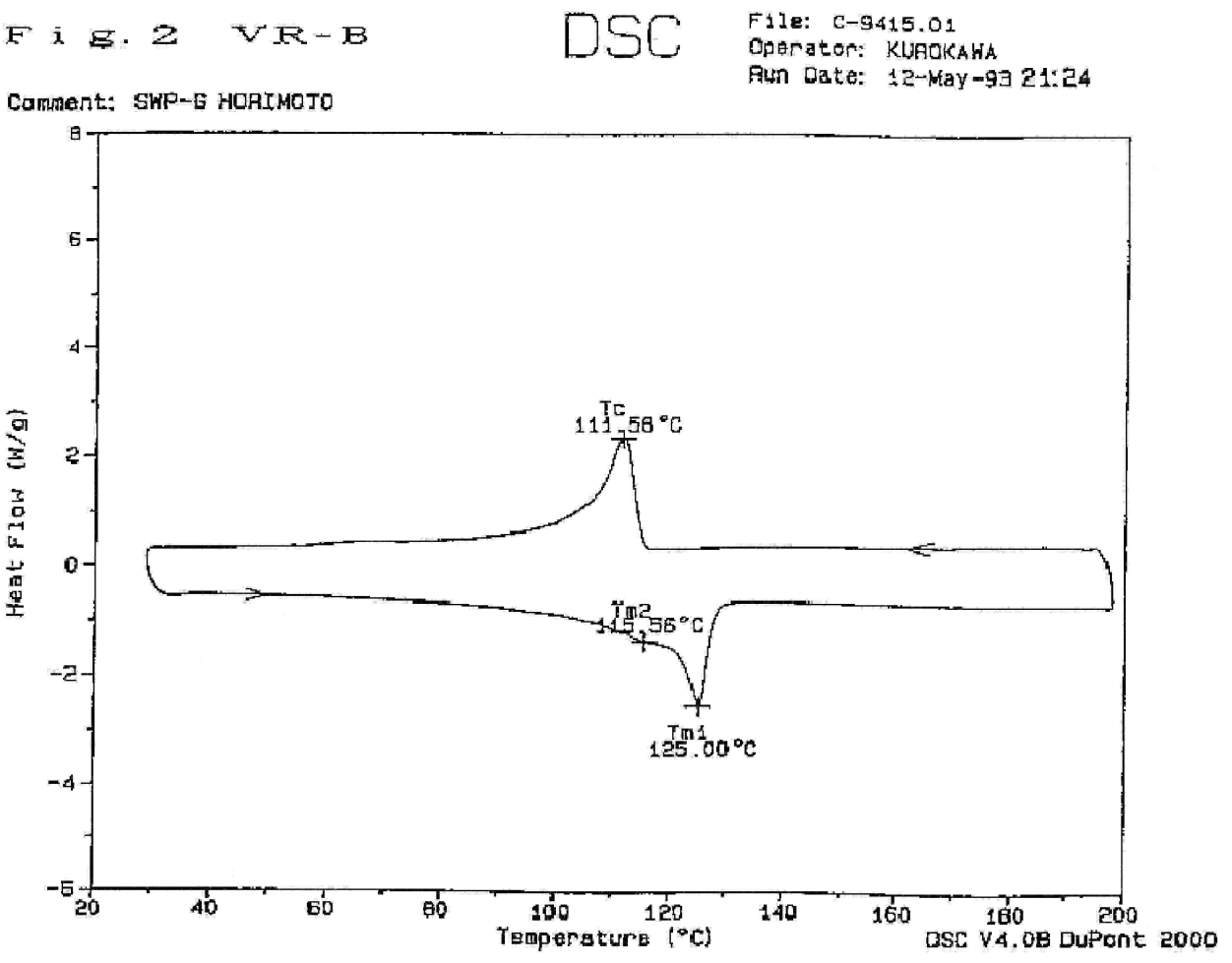

DSC
File: C-9415.01
Operator: KUROKAWA
Run Date: 12-May-93 21:24
Comment: SWP-G HORIMOTO
Tc
111.58°C
Tm2
115.56°C
Tm1
125.00°C
Heat Flow (W/g)
Temperature (°C)
DSC V4.0B DuPont 2000

Fig. 3 Vinyon DSC

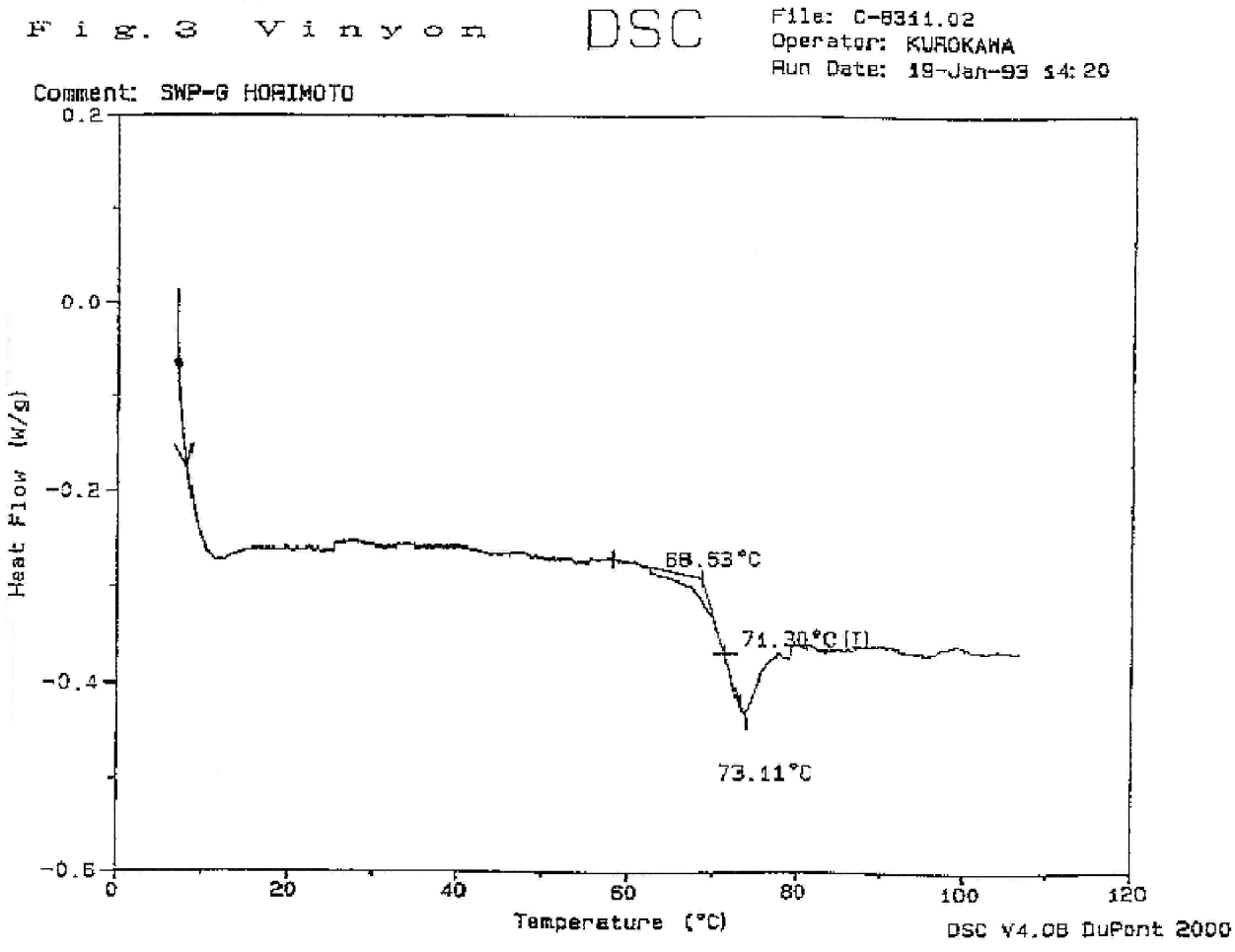


Fig. 4 Heat Seal Strength of Various Fibers