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MOLECULAR WEIGHT DISTRIBUTION OF PERFLUOROPOLYETHERS  
BY FRACTIONATING DISTILLATION

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The perfluoropolyethers, are a liquid linear polymer,  $CF_3[(OCF_2CF_2(CF_3))_m(OCF_2)_n]OCF_3$ . They are synthesized by photochemical reaction of UV radiation. The inert perfluoropolyethers was developed commercially by the Montedison and was distilled under high vacuum for obtaining fractions of increasing molecular weight. The molecular weight of perfluoropolyethers can be controlled by acting on photosynthesis conditions. Generally its average value is of the order of few thousands. The oxyhexafluoropropene and oxydifluoromethylene units are randomly distributed along the chain. The raw perfluoropolyethers have a large molecular weight distribution, but several restricted molecular weight fractions with controlled properties can be obtained by fractionating distillation.

The molecular weight distribution of 3 types of commercial FOMBLIN Y-VAC (06/6, 18/8 and 25/5) was determined by viscosity of several distilled fractions into a glass high vacuum line at 0,1 mm Hg according to ASTM D1160/61. The distillation conditions for each FOMBLIN Y-VAC type was following:

SAMPLE	DISTILLATION RANGE (°C)	HEATING RATE (°C/h)	DISTILLATION RATE (ml/h)
Y-VAC 25/5	60-250	15,6	12
Y-VAC 18/8	70-210	20	20
Y-VAC 06/6	80-170	9,5	8,5

These results show that for each 1 ml of oil distilled it is necessary increases the temperature of 1°C and it depends of the distillation range and type of FOMBLIN Y-VAC.

The kinematic viscosity of each distilled fraction was determined, from 20°C, by using standard Ostwald capillary viscometer, in cStokes. The viscosity-molecular weight relationship used was  $\eta_{20^\circ\text{C}} = 5,3 \times 10^{-7} \text{ Mn}^{2.474}$  from literature.

In the liquid polymers the entanglements and enasmuch molecular and branching effects are responsible for a change in the molecular weight dependence of viscosity. These effects are observed from critical molecular weight,  $M_c$ , related to the chain length which promotes molecular entanglements.  $M_c > 10,000$  of FOMBLIN Y-VAC. The  $M_n$  ranges of commercial oil distilled are: Y-VAC 06/6: 1450-2800; Y-VAC 18/8: 2300-3800; Y-VAC 25/5: 1800-6200 and they are according to literature (Y-VAC 06/6: 1500-2350; Y-VAC 18/8: 2350-3150; Y-VAC 25/9: 2750-4000). Therefore the distillation high vacuum line performance was testified and it was considered suitable to determine the molecular weight distribution and separated molecular weight range of interesting for the perfluoropolyether developed in IPEN.

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