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NASA TECH BRIEF

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Preparation of Perfluoropolyether Prepolymers

A new group of fluorinated prepolymers can be used to generate a wide variety of highly fluorinated polymers. The polymers possess most of the desirable properties of polytetrafluoroethylene, such as nonflammability and high corrosion resistance, while retaining good low temperature flexibility.

The prepolymers have the general formula:

$$X[CF(CF_3)O(CF_2)_pOCF(CF_3)]_nX$$

where n is an integer from 2 to 12,

p is an integer from 2 to 23, and

X is an organic group, either the acid fluoride -COF or the methanol group $-CH_2OH$.

The prepolymers are derived by subjecting a diacid fluoride perfluoroether (the above formula with n = 1 and X = -COF) to ultraviolet irradiation. By a process of photochemical coupling, molecules bearing the acid fluoride termination are created with the value of n ranging from 2 to 12. The predominant value of n in the product may be controlled by varying either the intensity and wavelength of the UV or the exposure time. Satisfactory prepolymers, with n ranging from 2 to 4 (molecular weight approximately 1200 to 2300), have been obtained through irradiation for four days with a 450 watt UV source.

To obtain hydroxy-terminated (diol) compounds, which are even more useful as prepolymers, the acid fluoride-terminated form is reduced by reaction with either lithium aluminum hydride or sodium borohydride. The prepolymer is dissolved in a solvent such as Freon 113, and the solution is added to the reducing agent dissolved in diethylene glycol dimethyl ether. The reaction is performed under anhydrous conditions to prevent hydrolysis of the acid fluoride group.

Notes:

1. Information on a continuation of this work, involving the use of the perfluoropolyether prepolymers to form fluorinated polyurethanes, may be found in NASA Tech Brief B71-10005. Other related information is contained in NASA Tech Brief B70-10353.
2. Requests for further information may be directed to:

   Technology Utilization Officer
   NASA Pasadena Office
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: TSP71-10004

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to:

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