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NASA TECH BRIEF

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Preparation of Highly Fluorinated Polyurethanes

A new family of fluorinated polyurethanes has been formulated. The polyurethanes possess most of the desirable properties of polytetrafluoroethylene, such as nonflammability and high corrosion resistance, yet have good low temperature flexibility. Being elastomers, the new materials may be used in bladders, seals, gaskets, protective coatings, and many similar applications.

The compounds have the general formula:

$$\left[CH_2[CF(CF_3)O(CF_2)_pOCF(CF_2)]_nCH_2O\overset{O}{\overset{\|}{C}}NHRNH\overset{O}{\overset{\|}{C}}O\right]_y$$

where n is an integer from 1 to 12,
p is an integer from 2 to 23,
y is an integer from 1 to 1000, and
R is any radical suitable for linking two isocyanate groups, preferably a low-order fluorinated alkylene or phenylene group.

The polymers are formed from the reaction of a prepolymer diol (see note 1) with a suitable diisocyanate. Although tetrafluoro-m-phenylene diisocyanate has been used in all preparations to date, many other diisocyanates, including those commonly used to prepare conventional polyurethanes, could probably be used. The perfluorinated diisocyanates are preferred, however, since they seem to be more compatible with the prepolymer.

The polymers formed have ranged from sticky semi-solids to tough, brittle sheets, depending on the relative amounts of diisocyanate and prepolymer used, on the molecular weight of the prepolymer, and on the amount of cross-linking developed between the polymer chains. Although the hardness of the polymer increases rapidly with increasing ratio of diisocyanate to diol, the glass transition temperature of the polymer is not adversely affected.

Notes:

1. Related information, involving preparation of the precursor molecules used to form the polyurethane, can be found in NASA Tech Briefs B70-10353 and B71-10004.
2. Requests for further information may be directed to:

   Technology Utilization Officer
   NASA Pasadena Office
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: TSP71-10005

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:

Patent Counsel
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