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NASA TECH BRIEF

Polymerization of Perfluorobutadiene

A new polymer form of perfluorobutadiene and a new method of production has been developed. Previous methods required extremely high pressures, on the order of 10^4 atmospheres, which placed severe limitations on the equipment, besides increasing hazards and production costs.

The polyperfluorobutadiene obtained by this method has good chemical resistance and can be used where hard elastomers are required. It can also serve as a prepolymer to form high molecular weight material with excellent temperature and other properties.

In the new method, diisopropyl peroxydicarbonate is used as a catalyst to initiate the polymerization of polyperfluorobutadiene. The peroxydicarbonate is dissolved directly in the liquid perfluorobutadiene and the reaction conducted in a sealed vessel at the autogenous pressure of polymerization. The reaction temperature, the ratio of catalyst to monomer, and the amount of agitation determine the degree of polymerization and product yield. With increased temperature (up to about 50°C) or amount of catalyst, the molecular weight of the polymer tends to decrease, while the yield tends to increase.

Analysis of the polyperfluorobutadiene indicates that it is a copolymer of perfluoro-1, 2- and 1, 4-butadiene. It has the advantage of two types of double bonds (terminal and internal) which are easily susceptible to cross-linking reactions and graft copolymerizations.

One advantage of diisopropyl peroxydicarbonate as a catalyst is that it is miscible with the perfluorobutadiene monomer. At least 0.10 weight percent of the catalyst is needed to obtain polymerization. Because it decomposes at 5°C, the solid catalyst is placed into a precooled pressure vessel which is attached to a vacuum line and evacuated. The vessel is further cooled in a liquid nitrogen or dry-ice/acetone bath and perfluorobutadiene is condensed into it. The vessel is then sealed and the materials mixed continuously during the reaction period, which can last from 24 hours to several weeks.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
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Reference: B70-10131

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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Category 04