Accepted Manuscript

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PII: S0079-6700(17)30167-3
DOI: https://doi.org/10.1016/j.progpolymsci.2018.01.005
Reference: JPPS 1068

To appear in: *Progress in Polymer Science*

Received date: 20-7-2017
Revised date: 22-11-2017
Accepted date: 17-1-2018

Please cite this article as: Friesen Chadron Mark, Ameduri Bruno.Outstanding Telechelic Perfluoropolyalkylethers and Applications Therefrom.*Progress in Polymer Science* https://doi.org/10.1016/j.progpolymsci.2018.01.005

Outstanding Telechelic Perfluoropolyalkylethers and Applications Therefrom

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Abstract

An overview on the synthesis and applications of telechelic perfluoropolyalkylethers (PFPAEs) is presented. First, a non-exhaustive summary on the synthesis and properties of commercially available PFPAEs is supplied, followed by conventional strategies for the preparation of telechelic PFPAEs ranging from direct fluorination, anionic ring-opening polymerization of oxetane and hexafluoropropylene oxide, to photochemical radical polymerization of tetrafluoroethylene, hexafluoropropene, or perfluoromethyl vinyl ether in the presence of oxygen. Properties (chemical, physical, and thermal) and characterizations (NMR, MALDI, rheology, lubricity, and toxicity) of these PFPAEs will also be presented. Telechelic PFPFA bis(acylfluorides) are interesting precursors for a wide range of molecules and copolymers such as: polycondensates (polyesters, polyurethanes, polycarbonates, polyethers), macromonomers that can further be cross-linked, triblock copolymers, and (semi) interpenetrated polymer networks. Furthermore, important applications of these modified PFPAEs will be exhibited. These applications range from self-assembly materials (e.g. amphiphilic and anti-bacterial derivatives, and hydrogels), aerospace materials, microfluidic devices, protective coatings (e.g. low surface tension , anti-fouling, and de-icing), optically transparent films, self-healing materials, thermoplastic elastomers, materials for energy (e.g. zinc-air and lithium ion batteries, polymeric electrolyte membranes for fuel cells), resistant photoresists for lithographic materials, to theranostics (e.g. intracellular pH measurements and in vivo cell tracking technologies using Magnetic Resonance Imaging). This overview summarizes these emerging fields, emphasizing structural variety, end group functionalities, post-polymerization modifications, and applications previously unobtainable without accessible to these new materials.

Abbreviations

AFM	**atomic force microscopy**
ARF	adhesion-reduction-factor
AIBN	azobisisobutyronitrile
Bar	barometric pressure
BDO	1,4-butandiol
BME	benzoin methyl ether
BPO	benzoyl peroxide
BVE	bisvinylether