Claims:

1. A process for the preparation of isoolefin polymers, the process comprising the step of:
a) providing a reaction medium comprising an organic diluent, at least one monomer being an isoolefin and an initiator system comprising
- aluminium trichloride and
- at least one tertiary ether, wherein the molar ratio of the tertiary ether to a sum of aluminum atoms of the aluminum trichloride is from 0.001 to 0.200

and
b) polymerizing the at least one monomer within the reaction medium in the presence of the initiator system at a temperature in the range of -100°C to -60°C to form a product medium comprising the isoolefin polymer, the organic diluent and optionally residual monomer(s),
wherein the organic diluent, the monomer, the aluminium trichloride and the tertiary ether are fed continuously to a reaction vessel.

2. The process according to claim 1, wherein the isoolefin is isobutene.

3. The process according to claim 1 or 2, wherein the reaction medium further comprises multiolefins.

4. The process according to claim 3, wherein the multiolefin is isoprene.

5. The process according to any one of claims 1 to 4, wherein the reaction medium further comprises monomers that are copolymerized with the at least one isoolefin and are neither isoolefins nor multiolefins.

6. The process according to any one of claims 1 to 5, wherein the diluents include hydrochlorocarbon(s) ; hydrofluorocarbons represented by the formula: $C_xH_yF_z$ wherein x is an integer from 1 to 40 and wherein y and z are integers and at least one; unsaturated hydrofluorocarbons; hydrocarbons.

7. The process according to any one of claims 1 to 6, wherein the tertiary ethers are methyl tert.-butyl ether (MTBE), ethyl tert.-butyl ether (ETBE), methyl tert.-amyl ether (MTAE) and phenyl tert.-butyl ether (PTBE) or mixtures thereof.

8. The process according to any one of claims 1 to 7, wherein the isoolefin polymer

comprises a molar ratio for 1,4-isoprene structures to branched unsaturated structures of 14.0 to 20.0.

9. The process according to any one of claims 1 to 8, wherein the isoolefin polymer comprises a weight ratio of C_{21} to C_{13} of from 0.9 to 2.0.

10. The process according to claims 8 or 9, wherein the isoolefin polymer comprises C_{13} and C_{21} structures in an amount of less than 800 ppm.

11. The process according to any one of claims 1 to 10, wherein the isoolefin polymer comprises a polydispersity index, as measured by the ratio of weight average molecular weight to number average molecular weight as determined by gel permeation chromatography, of 1.5 to 4.5.

12. A process for forming a rubber product, wherein the process comprises

a) providing a reaction medium comprising an organic diluent, at least one monomer being an isoolefin and an initiator system comprising

- aluminium trichloride and
- at least one tertiary ether, wherein the molar ratio of the tertiary ether to a sum of aluminum atoms of the aluminum trichloride is from 0.001 to 0.200, wherein the organic diluent, the monomer, the aluminium trichloride and the tertiary ether are fed continuously to a reaction vessel;

b) polymerizing the at least one monomer within the reaction medium in the presence of the initiator system at a temperature in the range of -100°C to -60°C to form a product medium comprising the isoolefin polymer, the organic diluent and optionally residual monomer(s);

the step of forming the isoolefin polymer into the rubber product; and

optionally the step of curing the rubber product.

13. The process according to claim 12, wherein the process further comprises blending the isoolefin polymer with at least one secondary rubber, optionally forming the isoolefin polymer and secondary rubber into a rubber product, and optionally curing the rubber product.