

PROCESS TO PRODUCE LOW VISCOSITY POLY-ALPHA-OLEFINS

ABSTRACT

This invention relates to a process to produce a polyalpha-olefin comprising:

1) contacting one or more alpha-olefin monomers having 3 to 24 carbon atoms with an unbridged substituted bis cyclopentadienyl transition metal compound having: 1) at least one non-isoolefin substitution on both cyclopentadienyl rings, or 2) at least two substitutions on at least one cyclopentadienyl ring, a non-coordinating anion activator, and optionally an alkyl-aluminum compound, where the molar ratio of transition metal compound to activator is 10:1 to 0.1:1, and if the alkyl aluminum compound is present then the molar ratio of alkyl aluminum compound to transition metal compound is 1:4 to 4000:1, under polymerization conditions wherein:

i) hydrogen is present at a partial pressure of 0.1 to 50 psi, based upon the total pressure of the reactor or the concentration of the hydrogen is from 1 to 10,000 ppm or less by weight ;

ii) wherein the alpha-olefin monomer(s) having 3 to 24 carbon atoms are present at 10 volume % or more based upon the total volume of the catalyst/activator/alkylaluminum compound solutions, monomers, and any diluents or solvents present in the reaction;

iii) the residence time of the reaction is at least 5 minutes;

iv) the productivity of the process is at least 43,000 grams of total product per gram of transition metal compound;

v) the process is continuous or semi-continuous, and

vi) the temperature in the reaction zone does not rise by more than 10 °C during the reaction; and

vii) ethylene is not present at more than 30 volume % of the monomers entering the reaction zone;

and

2) obtaining a polyalpha-olefin (PAO), optionally hydrogenating the PAO, wherein the PAO comprises at least 50 mole% of a C3 to C24 alpha-olefin monomer, and wherein the PAO has a kinematic viscosity at 100°C of 20 cSt or less.