increasing the residence time it can lead to reactor sheeting or lumping or chunking in the reactor and again to a long stop for cleaning the reactor system.

SUMMARY

In one aspect, there is provided a process for the preparation of an alkene interpolymer, comprising: polymerizing at least one 3-substituted C_{4-10} alkene and at least one C_{2-8} alkene in a gas phase polymerization using a polymerization catalyst system, wherein said catalyst system comprising a transition metal compound and an activator and wherein said catalyst system is in particulate form.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a plot of catalyst system activity coefficient versus polyethylene density for a polymerization carried out with a single site catalyst.

Figure 2 is a plot of catalyst system activity coefficient versus polyethylene density for a polymerization carried out with a Ziegler Natta catalyst.

DETAILED DESCRIPTION OF THE INVENTION

In view of the drawbacks of the background art, there is a need for alternative polymerization processes for the preparation of alkene polymers and, in particular, alkene interpolymers that enable the amount of catalyst system needed to make a given amount of polymer to be minimized. Processes that enable the reaction to be carried out under conventional gas phase polymerization conditions (i. e. typical temperature and pressure conditions) as well as in existing gas phase reactors are especially desired.

It has now been surprisingly found that the productivity (i. e. ton polymer/kg catalyst system) of polymerization catalyst system in the gas phase polymerization of 1-alkenes such as ethylene is significantly increased by using a 3-substituted C_{4-10} alkene as comonomer rather than a conventional non-substituted, linear C_{4-10} alkene. As a result, a significantly lower amount of catalyst system can be used to manufacture a given amount of an interpolymer comprising the 3-substituted C_{4-10} alkene (i. e. catalyst system productivity is significantly increased). Advantageously the major properties of a 1-alkene/3-substituted C_{4-10} alkene interpolymer (e. g. MFR_2,

density, melting point, Mw, Mn and molecular weight distribution) may be maintained on a comparable level to the properties of the conventional 1-alkene/non-substituted, linear C_{4-10} alkene interpolymer. Thus the process herein described offers an economically attractive approach for making interpolymers that can be used as substitutes for the ethylene/1-hexene and ethylene/1-octene copolymers commercially available.

Table 2b: Gas phase polymerization with Ziegler Natta catalyst (comparative examples)

Run no		10	11	12	14	17	15	19	20	21	23	24
POLYMERIZATIO N												
Catalyst feed	g	0.230	0.259	0.271	0.256	0.258	0.245	0.241	0.253	0.253	0.250	0.242
TEAL (1 M) solution	ml	3.2	3.3	3.4	3.4	3.4	3.3	3.3	3.4	3.4	3.4	3.3
Total pressure	bar g	21	21	21	21	21	21	21	21	21	21	21
Hydrogen partial pressure start	bar g	0.5	0.5	0.6	0.5	0.5	0.47	0.5	0.5	0.5	0.5	0.5
Comonomer type*		Hexene	Hexene	Hexene	Hexene	Hexene	Hexene	Butene	Butene	Butene	Butene	Butene
Comonomer start	ml	10	10	0	5	5	5	5.6	5.5	8.25	8.25	8.25
Comonomer (continuous)	g/100 g ethylene	3	3	3	3/2.5/2/ 1.5	2.0/1.5/ 1.0/0.5/ 0.3	2.5/3/2. 5/2.0/1. 5/1.0/0. 5	Man. feed	5/7/5/7/ 10/7	10/10/5/ 10/10/1 0	10/5/	10/5/7/10/ 15
Run time	min	165	180	180	115	180	180	150	180	180	180	140
Yield	g	227	922	600	630	627	555	347	542	382	457	317
Productivity	kg PE/(g cat.)	1.0	3.6	2.2	2.5	2.4	2.3	1.4	2.1	1.5	1.8	1.3
Activity coefficient	g PE/(g cat.,h, bar)	65	216	134	233	147	137	102	127	91	109	101
Ash	wt ppm	1590	420	680	620	630	680	1100	730	1030	860	1190
POLYMER ANALYSES OF POWDER												
MFR2	g/10 min	1.3	0.31	1.9	0.6	0.66	0.95	0.43	0.79	0.96	0.54	0.98
MFR21	g/10 min	33	6.2	46	13	14	22	9	18	22	11	22
Mw	g/mol	135 007	194 113	122 954	163 939	162 310	146 576	188 733	153 864		171 503	144 771
Comon. content (FT-IR)	wt %	3.5	6.5	4.5	6.0	3.8	4.9	2.8	2.8	3.1	3.0	3.7
Density	kg/dm3	935	926	930	927	931.7	929.7	935.1	935	934.4	934	933

* M1B: 3-methyl-1-butene