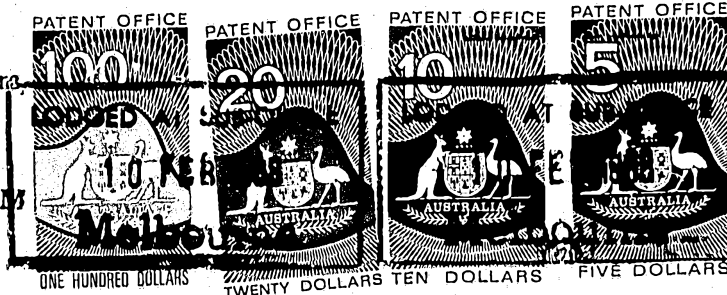
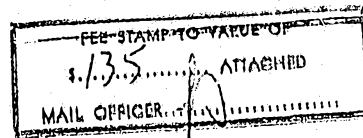


(CONVENTION. By one or more

603422 COM



CONVENTION APPLICATION FOR A PATENT



(1) Here insert (in full) Name or Names of Applicant or Applicants, followed by Address (es).

kx (1) HOECHST AKTIENGESELLSCHAFT
We

of 45 Bruningstrasse, D6230 Frankfurt/Main 80,

Federal Republic of Germany

(2) Here insert Title of Invention.

hereby apply for the grant of a Patent for an invention entitled: (2)

POLYPROPYLENE MOLDING MATERIAL

(3) Here insert number(s) of basic application(s)

which is described in the accompanying complete specification. This application is a Convention application and is based on the application numbered (3)

P37 04 207.6

(4) Here insert Name of basic Country or Countries, and basic date or dates

for a patent or similar protection made in (4) Federal Republic of Germany on 11th February 1987

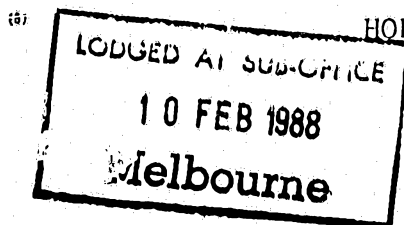
APPLICATION ACCEPTED AND AMENDMENTS

ALLOWED 22.2.90

My address for service is Messrs. Edwd. Waters & Sons, Patent Attorneys,
Our 50 Queen Street, Melbourne, Victoria, Australia.

DATED this 9th day of February 1988

(5) Signature (s) of Applicant (s) or Seal of Company and Signatures of its Officers as prescribed by its Articles of Association.



HOECHST AKTIENGESELLSCHAFT

by *[Signature]*

D. B. Mischlewski

registered Patent Attorney

To:

87/1042

COMMONWEALTH OF AUSTRALIA - Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION UNDER PART XVI., FOR A PATENT

In support of the Convention application made under Part XVI. of the Patents Act 1952 by
HOECHST AKTIENGESELLSCHAFT D-6230 Frankfurt am Main 80, Federal Republic of Germany

for a patent for an invention entitled:
Polypropylene Molding Material

I/We, Ulrich Tergau, Am Dornbusch 3, D-6239 Eppstein/Taunus (Fed.Rep.of Germany
Franz Lapice, Sandweg 2, D-6233 Kelkheim (Taunus)

do solemnly and sincerely declare as follows:

1. We are authorized by HOECHST AKTIENGESELLSCHAFT
the applicant/s for the patent to make this declaration on its/their behalf.
2. The basic application/s as defined by Section 141 of the Act was/were made
by HOECHST AKTIENGESELLSCHAFT

Federal Republic of Germany P 37 04 207.6 of February 11,1987

3.
 - 1) Jürgen Helberg, Johann-Strauß-Straße 60, D-6233 Kelkheim (Taunus)
 - 2) Gert Heufer, Sperberstraße 103, D-6232 Bad Soden am Taunus
 - 3) Friedrich Kloos, Südring 112, D-6500 Mainz
 - 4) Wolfgang Löw, Lindenstraße 48, D-6097 Trebur
- 1)-4) Federal Republic of Germany

is/are the actual inventor/s of the invention and the facts upon which
HOECHST AKTIENGESELLSCHAFT

is/are entitled to make the application are as follows:
The said HOECHST AKTIENGESELLSCHAFT
is/are the assignee/s of the said inventor/s

4. The basic application/s referred to in paragraph 2 of this Declaration was/were the
the first application/s made in a Convention country in respect of the invention the
subject of the application.

Dated Frankfurt am Main, Fed.Rep.of Germany, February 26,1990

HOECHST AKTIENGESELLSCHAFT

ppa. Tergau
ppa. Tergau

i.V. Lapice
i.V. Lapice

To the Commissioner of Patents

(12) PATENT ABRIDGMENT (11) Document No. AU-B-11485/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 603422

(54) Title
POLYPROPYLENE MOLDING MATERIAL

(51)⁴ International Patent Classification(s)
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C08K 005/34

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3122

(56) Prior Art Documents
AU 31639/84 C08L 23/06 23/12
AU 79889/75 C08L 23/12 C08F 4/64
EP 137482

(57) Claim

1. A polypropylene molding material ~~essentially~~ consisting of a homopolymer of propylene or a copolymer of propylene with ethylene or butene, having a melt flow index MFI 230/5 of less than or equal to 5 g/10 min and containing 0.001 to 0.5% by weight, based on the molding material, of ^{one} nucleating agent from the group consisting of sodium benzoate, sodium montanate, calcium montanate, aluminum p-tert-butylbenzoate, quinacridone, naphthalimide, dibenzylidenesorbitol, ~~and~~ ultrafine talc.

603422

Form 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952-69

COMPLETE SPECIFICATION

(ORIGINAL)

Class

Int. Class

Application Number:
Lodged:

Complete Specification Lodged:

Accepted:

Published:

Priority:

Related Art:

This document contains the
amendments made under
Section 49 and is correct for
printing.

Name of Applicant: HOECHST AKTIENGESELLSCHAFT

Address of Applicant: 45 Bruningstrasse, D-6230 Frankfurt/Main 80, Federal
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Actual Inventor: JURGEN HELBERG, GERT HEUFER, FRIEDRICH KLOSS and
WOLFGANG LOW

Address for Service: EDWD, WATERS & SONS,
50 QUEEN STREET, MELBOURNE, AUSTRALIA, 3000.

Complete Specification for the invention entitled:
POLYPROPYLENE MOLDING MATERIAL

The following statement is a full description of this invention, including the best method of performing it known to : us

Description

Polypropylene molding material

The invention relates to a polypropylene molding material having improved processing characteristics and
5 improved properties.

In the processing of polypropylene, the processing speed and the properties prove inadequate in many cases. There has therefore been no lack of attempts to overcome these deficiencies.

10 It is known that partially crystalline thermoplastics, such as polypropylene, can be advantageously affected in terms of processing characteristics and properties in many cases by adding suitable crystallization seeds, so-called nucleating agents. Nucleation leads to a finely
15 spherulitic structure and a higher crystallization temperature.

The consequence of this is that the product to be prepared is dimensionally stable at a higher temperature and can therefore be removed from the mold at an earlier
20 stage. This results in a substantial reduction in the cycle time during injection molding, in particular in the case of thick-walled parts, and in an increase in the take-off speed during extrusion.

The finely spherulitic structure leads to higher transparency and, because of the higher crystallization temperature, to increased crystallinity. At the same time there is an improvement in the hardness and rigidity of the moldings produced therefrom, but a reduction in the toughness properties. This undesired effect has considerably
25 restricted the use of nucleating agents in many
30 cases.

It is known that by adding -quinacridone to a high molecular weight propylene homopolymer (cf. German Auslegeschrift 1,188,279) the hardness and toughness of the moldings produced therefrom is increased. α - and β -quinacridones have only a slight effect; they increase only the hardness without producing any increase at all in the toughness.

Furthermore, the use of aluminum p-tert-butylbenzoate and dibenzylidenesorbitol as nucleating agents for propylene copolymer is known (cf. EP-A-137,482). However, talc is added to increase or maintain the low-temperature toughness. An improvement in the transparency and satisfactory rigidity and low-temperature toughness are achieved. Improvement of the hardness is not mentioned. EP-A-137,482 suggests that the desired effects of talc addition cannot be obtained if the amount added is less than 0.01 parts by weight. Similarly, if the quantity added is in excess of 3.0 parts by weight, the transparency of the copolymer composition is poor.

It was the object to find a propylene polymer for moldings having improved toughness and hardness.

It has been found that the object can be achieved by a propylene polymer which contains certain nucleating agents.

The invention therefore relates to a polypropylene molding material essentially consisting of a homopolymer or a copolymer of propylene with ethylene or butene, having a melt flow index MFI 230/5 of less than or equal to 5 g/10 min and containing 0.001 to 0.5% by weight, based on the molding material, of one nucleating agent from the group consisting of sodium benzoate, sodium montanate, calcium montanate, aluminium p-tert-butylbenzoate, quinacridone, naphthalimide, dibenzylidenesorbitol and ultrafine talc. The effectiveness of talc as a nucleating agent is especially surprising in the light of the prior art.



- 2a -

Suitable homopolymer and copolymers for the molding material according to the invention are homopolymers and copolymers of polypropylene with ethylene or butene which have a high molecular weight. Their melt flow index MFI

5 230/5 is less than or equal to 5 g/10 min (MFI

10

15
20

25

30

35



230/2.16 $\leq$ about 1 g/10 min), preferably less than or equal to 2 g/10 min (MFI 230/2.16 $\leq$ about 0.5 g/10 min).

5 The nucleating agents used are sodium benzoate, sodium montanate, calcium montanate, aluminum p-tert-butylbenzoate, quinacridone, naphthalimide, dibenzylidenesorbitol and ultrafine talc. Sodium benzoate, quinacridone and ultrafine talc are preferred, in particular sodium benzoate. The particle size of these nucleating agents is less than or equal to 20 μ m, preferably less than or
10 equal to 10 μ m. The substances are added to the polymer in an amount of 0.001 to 0.5% by weight, preferably 0.001 to 0.15% by weight.

15 The molding material according to the invention can contain the conventional additives which facilitate processing and improve the physical and chemical properties. Examples of these are light stabilizers and heat stabilizers, antioxidants, antistatic agents, lubricants, anti-blocking agents and fillers and reinforcing agents, colored pigments, synthetic and natural resins, rubber-like products and flameproofing agents. The first group
20 is present in the molding material in general in an amount of 0.01 to 5% by weight, based on the amount of polymer (+ filler). Fillers and reinforcing agents, colored pigments, synthetic and natural resins, rubber-like products and flameproofing agents are used in an amount corresponding to the particular requirements.
25

30 The nucleating agents are incorporated into the propylene polymer in a known manner, for example by means of a mixer, extruder, roll or kneader or by air homogenization, it being also possible to use a masterbatch of the nucleating agents for incorporation.

The molding material according to the invention not only results in improved toughness and improved hardness of the moldings in comparison with moldings obtained from

an identical molding material without the stated nucleating agents, but also possesses better processing characteristics. Thus, it permits shorter cycle times during injection molding and higher take-off speeds during extrusion of pipes and sections. Moreover, sticking of the plastic material to the mold is reduced during blow molding as a result of the formation of skin of higher crystallinity on the surface of the parison.

The molding material according to the invention can therefore particularly advantageously be used for producing thick-walled parts (for example cooling water reservoirs for motor vehicles) by injection molding, panels and pipes by extrusion and hollow articles, contoured articles (for example cases) and industrial articles (for example bumpers, spoilers, etc.) by blow molding.

If sodium benzoate is used as the nucleating agent, the presence of calcium stearate as an acid acceptor can be dispensed with. Calcium stearate furthermore has an adverse effect on nucleation with sodium benzoate.

The Examples which follow are intended to illustrate the invention:

Examples 1 to 7 and Comparative Examples A to D

Several high molecular weight ($\text{MFI } 230/5 \leq 5 \text{ g/10 min}$) and low molecular weight ($\text{MFI } 230/5 \geq 5 \text{ g/10 min}$) pulverulent homopolymers of propylene and copolymers of propylene with ethylene were mixed with various nucleating agents and, either as a powder or as granules, were processed to test specimens. In the same manner, test specimens which did not contain any nucleating agents were prepared for comparison. The hardness and the toughness of the test specimens were measured. The composition of the molding materials tested and the results of the measurements are summarized in Tables 1 and 2.

Table 1

Starting mixtures

(Comparative)

15

10 200 1144

Table 1 (continued)

(Comparative)

Examples	Type	Initial PP powder			Nucleating agent	
		APP (% by wt.)	C ₂ H ₄ (% by wt.)	MFI 230/5 (g/10 min)	Type	Concentration (% by wt.)
H1	Copolymer	-	9	18.5	-	-
H2	"	-	"	"	Na benzoate	0.3
I1	Homopolymer	2	-	55.4	-	-
I2	"	"	-	"	Ultrafine talc	0.3
K1	"	2	-	35.2	-	-
K2	"	"	-	"	Ultrafine talc	0.3
L1	Copolymer	-	9	21.1	-	-
L2	"	-	"	"	Ultrafine talc	0.3
M1	"	-	9	21	-	-
M2	"	-	"	"	Ultrafine talce	0.3

11 2 0 0 1 1 0 0

Table 2

FINISHED PRODUCTS

Comparative MFI 230/5 Form

Examp.

Hardness/rigidity

BIH¹⁾

FCM²⁾

1 min
value

Compressive strength

bottles (N)

akv³⁾

(mJ/mm²)

Strength in drop test

bottles⁴⁾

Drop test/sheets

H 50⁵⁾

	$\alpha/10$		(N/mm ²)	(N/mm ²)	3 mm	max.	23°C	0°C	-20°C	0°C	0°C	-20°C
										(cm)	(cm)	(cm)
A	0.94	Granules	65	-	-	-	16	-	-	-	-	-
1	0.93	"	68	-	-	-	25	-	-	-	-	-
B	0.83	Granules	51	-	-	-	12	-	-	-	-	-
2	0.85	"	53	-	-	-	21	-	-	-	-	-
C	0.25	Pulver	-	800	110	-	-	17	-	190	-	-
3	0.25	"	-	1150	165	-	-	30	-	250	-	-
N	0.6	Granules	-	850	123	-	-	15	-	150	-	-
3	0.6	"	-	1150	183	-	-	23	-	230	-	-
0	5.0	Granules	-	950	128	-	-	11	-	180	-	-
3	5.0	"	-	1160	210	-	-	11	-	200	-	-
D	6.0	Granules	56	-	161	193	-	10.7	-	186	-	-
4	6.2	"	62	-	179	213	-	14.1	-	167	-	-
E	3.7	Granules	54	877	-	-	34.8	18.1	14.4	-	240	130
5	3.8	"	58	1059	-	-	36.5	27.8	19.6	-	250	143

Table 2 (continued)

FINISHED PRODUCTS

Comparative MFI 230/5 Form			Hardness/rigidity									
Examp.	a/10		BIH ¹⁾	FCM ²⁾	Compressive strength		akv ³⁾ (mJ/mm ²)			Strength in drop test	Drop test/sheets	
				1 min.	bottles (N)					bottles ⁴⁾	H 50 ⁵⁾	
				value							0°C	-20°C
			(N/mm ²)	(N/mm ²)	3 mm	max.	23°C	0°C	-20°C	0°C	0°C	-20°C
										(cm)	(cm)	(cm)
F	3.7	Granules	54	877	-	-	34.8	18.1	14.4	-	240	130
6	3.5	"	56	963	-	-	36.8	23.3	-	-	260	160
G	3.7	Granules	54	877	-	-	34.8	18.1	14.4	-	240	130
7	4.0	"	56	1060	-	-	37.3	24.6	-	-	-	130
H1	21.8	Granules	58	1265	-	-	20.2	12.3	-	-	-	-
H2	24.4	"	64	1409	-	-	15.8	10.8	-	-	-	-
I1	62	Granules	80	1520	-	-	3.9	-	-	-	-	-
I2	63	"	89	1710	-	-	3.1	-	-	-	-	-
K1	165	Granules	85	1460	-	-	3.4	-	-	-	-	-
K2	163	"	92	1730	-	-	2.9	-	-	-	-	-
L1	59	Granules	62	1050	-	-	11.2	-	-	-	-	-
L2	60	"	65	1200	-	-	9.0	-	-	-	-	-
M1	160	Granules	57	980	-	-	7.4	-	-	-	-	-
M2	157	"	62	1070	-	-	5.2	-	-	-	-	-

Notes on Table 2

1) BIH: Ball indentation hardness, DIN 53,456, 4 mm sheet

2) FCM: Flexural creep modulus, 1 min value, flexural creep test $b = 5 \text{ N/mm}^2$

3) akv: notched impact strength, corresponding to DIN 53,453, standard small bar with V notch

4) Compressive strength/strength in drop test, bottles: (industrial test, Henkel)

10 a. Compressive strength

A defined hollow article (parting sand container 700 ml, 35 g) is subjected to a load, and the force in N is measured at 3 mm and maximum deformation.

b. Progressive drop test

15 Test temperature 0°C

30 thermostated bottles are filled with water and placed on a drop table and allowed to fall onto a concrete floor, the height of fall being increased stepwise. The bottles which have remained intact are tested again with an increased height of fall, until the final bottle has been destroyed.

The height at which 50% of the bottles are destroyed (h 50 value) is determined.

5) Drop test, sheets ("Lukall", Hoechst)

25 Test temperatures 23°C, 0°C, -20°C, -40°C

Falling ram 2 kg

6 sheets are tested in each case at different heights of fall. The end of the test corresponds to the height at which all 6 sheets are destroyed. The mean is calculated from this to give the mean height of fall.

30

~~PATENT CLAIMS~~ THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A polypropylene molding material ~~essentially~~ consisting of a homopolymer of propylene or a copolymer of propylene with ethylene or butene, having a melt flow index MFI 230/5 of less than or equal to 5 g/10 min and containing 0.001 to 0.5% by weight, based on the molding material, of ^{one} ~~a~~ nucleating agent from the group consisting of sodium benzoate, sodium montanate, calcium montanate, aluminum p-tert-butylbenzoate, quinacridone, naphthalimide, dibenzylidenesorbitol, ~~and~~ ultrafine talc.
2. A molding material as claimed in claim 1, wherein the nucleating agent is sodium benzoate, aluminum p-tert-butylbenzoate, calcium montanate, quinacridone or ultrafine talc.
3. A molding material as claimed in claim 2, wherein the nucleating agent is sodium benzoate, quinacridone or ultrafine talc.
4. A process for improving the hardness and toughness of propylene moldings by adding nucleating agents to the molding material intended for the production of the moldings, wherein 0.001 to 0.5% by weight, based on the molding material, of a nucleating agent from the group consisting of sodium benzoate, sodium montanate, calcium montanate, aluminum p-tert-butylbenzoate, quinacridone, naphthalimide, dibenzylidenesorbitol, ~~and~~ ultrafine talc is added to the molding material ~~essentially~~ ~~consisting~~ of a homopolymer of propylene or a copolymer of propylene with ethylene or butene, having a melt flow index MFI 230/5 of less than or equal to 5 g/10 min.
5. The process as claimed in claim 4, wherein the nucleating agent is sodium benzoate, aluminum p-tert-butylbenzoate, calcium montanate, quinacridone or ultrafine talc.

DATED this 9th day of February 1988.
HOECHST AKTIENGESELLSCHAFT

EDWD. WATERS & SONS.
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MELBOURNE. VIC. 3000.

