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**Datasheet for the decision  
of 27 June 2019**

**Case Number:** T 1789/15 - 3.3.02

**Application Number:** 07024738.2

**Publication Number:** 2072588

**IPC:** C09D123/06, C08L23/06

**Language of the proceedings:** EN

**Title of invention:**

Process for coating a pipe with high throughput using multimodal ethylene copolymer, and coated pipes obtained thereof

**Patent Proprietor:**

Borealis Technology Oy

**Opponent:**

Basell Polyolefine GmbH

**Headword:**

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

Inventive step

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

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Case Number: T 1789/15 - 3.3.02

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.02**  
**of 27 June 2019**

**Appellant:** Basell Polyolefine GmbH  
(Opponent) Brühler Strasse 60  
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**Decision under appeal:** **Decision of the Opposition Division of the  
European Patent Office posted on 6 July 2015  
rejecting the opposition filed against European  
patent No. 2072588 pursuant to Article 101(2)  
EPC.**

**Composition of the Board:**

**Chairman** M. O. Müller  
**Members:** A. Lenzen  
A. Jimenez

## Summary of Facts and Submissions

- I. This decision concerns the appeal filed by the opponent against the rejection of its opposition against European patent No. 2 072 588.
- II. In its notice of opposition, the opponent (hereinafter: appellant) requested the revocation of the patent in its entirety on the grounds that the claimed subject-matter was not inventive (Article 100(a) EPC) and that the patent did not disclose the invention in a manner sufficiently clear and complete for it to have been carried out by the person skilled in the art (Article 100(b) EPC).

The documents submitted during the opposition proceedings included:

D1 GB 2 094 810 A

D2 WO 97/03139 A1

D3 US 4,547,551

D7 Experimental Data performed by Borealis AG

- III. Together with its reply to the statement of grounds of appeal, the patent proprietor (hereinafter: respondent) filed, *inter alia*, sets of claims of auxiliary requests 1 to 3.
- IV. A communication pursuant to Article 15(1) RPBA was issued on 28 February 2019.

V. With its letter dated 27 May 2019, the respondent filed, *inter alia*, sets of claims of auxiliary requests 4 to 7.

VI. During the oral proceedings before the board on 27 June 2019, the appellant withdrew, *inter alia*, all its objections under Article 100(b) EPC. The respondent submitted:

D11 graphic entitled "MWD - Neck-in"

VII. The appellant requested that the decision of the opposition division be set aside and that the patent be revoked in its entirety.

VIII. The respondent requested that the appeal be dismissed (main request) or in the alternative that the patent in suit be maintained on the basis of:

- one of the sets of claims of auxiliary requests 1 to 3 filed with its reply to the statement of grounds of appeal, dated 14 March 2016
- one of the sets of claims of auxiliary requests 4 to 7 filed with its letter dated 27 May 2019

IX. The patent in suit as granted comprises two independent claims. They read as follows:

Claim 1:

"A pipe comprising an inner surface, an outer surface layer (A) and a coating layer (B) covering said outer surface layer (A)  
wherein the coating layer (B) comprises a coating composition (B-2), which comprises a multimodal

ethylene copolymer (B-1), being a copolymer of ethylene and one or more alpha-olefin comonomers having from 4 to 10 carbon atoms, in an amount of 80 to 100 % by weight, based on the weight of the coating composition (B-2),

wherein the multimodal ethylene copolymer (B-1) comprises

(B-1-1) from 40 to 60 % based on the weight of the multimodal ethylene copolymer (B-1) a low molecular weight ethylene homopolymer component, said low molecular weight ethylene homopolymer component having a weight average molecular weight of from 5000 g/mol to 35000 g/mol, and

(B-1-2) from 60 to 40 % based on the weight of the multimodal ethylene copolymer (B-1) a high molecular weight ethylene copolymer component being a copolymer of ethylene and one or more alpha-olefins having from 4 to 10 carbon atoms, said high molecular weight ethylene copolymer component having a weight average molecular weight of from 100000 g/mol to 700000 g/mol, and wherein the multimodal ethylene copolymer (B-1) has a weight average molecular weight of from 70000 g/mol to 250000 g/mol, the ratio of the weight average molecular weight to the number average molecular weight,  $M_w/M_n$ , of from 15 to 50, a melt index  $MFR_2$ , determined according to ISO 1133 at 190°C under a load of 2.16 kg, of from 0.05 g/10 min to 5 g/10 min, a melt index  $MFR_5$ , determined according to ISO 1133 at 190°C under a load of 5 kg, of from 0.5 to 10 g/10 min and a density of from 930 kg/m<sup>3</sup> to 955 kg/m<sup>3</sup>."

Claim 12:

"A process for producing a coated pipe according to any one of the preceding claims, comprising the steps of: providing a pipe having an outer surface layer (A); and

*applying said coating composition (B-2), which comprises said multimodal ethylene copolymer (B-1) in an amount of 80 to 100 % by weight, based on the weight of the coating composition (B-2), onto the pipe outer surface layer (A) to form a coating layer (B)."*

- X. The appellant's arguments as to the lack of an inventive step, insofar as they are relevant to the present decision, can be summarised as follows:

D2 was the closest prior art. The subject-matter of claims 1 and 12 of the patent in suit differed from D2 in that the molecular weight distribution of the multimodal ethylene copolymer B-1 was broader. The copolymer of comparative example 6R was not representative of copolymer #3 of example 2 of D2 and should not be taken into account when deriving a technical effect in relation to D2. Among the copolymers according to the multimodal ethylene copolymer B-1 in claim 1, the copolymer of example 7R was the only relevant one that could be compared with the copolymer of comparative example 6R. However, both copolymers differed from each other not only with regard to the breadth of their molecular weight distribution but also with respect to other parameters having an influence on the environmental stress cracking resistance. The reduction in neck-in was only very minor and had to be attributed to fluctuations. The multimodal ethylene copolymers according to B-1 in claim 1 covered only a part of the broad  $M_w/M_n$  range in claim 1. This shifted the burden of proof for an interrelation between the breadth of the molecular weight distribution and the reduction in neck-in to the respondent. Thus, the technical effects, as alleged by the respondent, were not to be taken into account. Moreover, these effects could not be acknowledged over

the whole breadth of claims 1 and 12. The copolymers of examples 2 to 5 showed an environmental stress cracking resistance which was worse than the one of comparative example 6R. The neck-in effect only came into play when pipes were coated using the winding technique during which the copolymer melt was extruded through a slit die. Claim 12, however, was not limited in this respect but also covered coating processes during which the copolymer melt was extruded through, for instance, a crosshead circular die. D2 disclosed that the broad molecular weight distributions of its copolymers were advantageous with regard to the effects addressed by the patent in suit as was evident from the sentence on page 5, lines 15 to 17. Following the teaching of D2 alone would have inevitably led the skilled person to the claimed invention. Both D1 and D3 related to bimodal ethylene copolymers and the breadth of their molecular weight distributions corresponded to that of the patent in suit. Both documents also specified the environmental stress cracking resistance of their copolymers, and D1 even described that a broad molecular weight distribution was advantageous in terms of processability of the copolymer. Thus, also a combination of D2 with D1 or D3 would have led the skilled person in an obvious way to the claimed invention.

XI. The respondent's arguments as to the presence of an inventive step, insofar as they are relevant to the present decision, can be summarised as follows:

D2 was the closest prior art. The subject-matter of claims 1 and 12 of the patent in suit differed from D2 in that the molecular weight distribution of the multimodal ethylene copolymer B-1 was broader. The breadth of the molecular weight distribution of the



copolymer of comparative example 6R and copolymer #3 of example 2 of D2 was the same. This was decisive as a technical effect was to be derived with respect to this parameter. A comparison of the copolymers of comparative example 6R and example 7R showed an improvement regarding both environmental stress cracking resistance and neck-in. Such a comparison was valid as the most prominent difference between these two copolymers was the breadth of their molecular weight distribution. All the multimodal ethylene copolymers according to B-1 in claim 1 performed better with respect to neck-in than the copolymer of comparative example 6R, and this could reasonably be assumed to also apply to those copolymers whose  $M_w/M_n$  values were close to the borders of the corresponding range in claim 1. In view of the examples provided by the respondent, the burden to prove the contrary was on the appellant. The allegation of fact that the neck-in effect only came into play when using slit dies was put forward for the first time during oral proceedings. It should not be admitted. In as much as the effects sought in the patent in suit were addressed by D2, they were traced back to the multimodality of the copolymers described in D2 and not to the fact that their molecular weight distribution was broad. The sentence on page 5, lines 15 to 17, was misread by the appellant. D2 alone could not lead to the claimed invention as the range of  $FRR_{21/5}$  values described in this document did not correspond to the range of  $M_w/M_n$  values in claim 1. There was no general teaching in D2 associating the breadth of the molecular weight distribution with the effects of environmental stress cracking resistance or neck-in. This also applied to D1 and D3 in as much as the effect of environmental stress cracking resistance was concerned. The processability referred to in D1 could not be equated to a reduction

in neck-in. The claimed subject-matter therefore involved an inventive step.

## **Reasons for the Decision**

Main request - inventive step (Article 56 EPC)

### 1. Closest prior art

During the oral proceedings before the board, the appellant withdrew its inventive step attack based on D3 as closest prior art. Both parties thus agreed on D2 as closest prior art.

D2 (page 1, paragraphs 1 and 5; page 9, paragraph 2) relates to coating compositions comprising a multimodal ethylene polymer and their use for coating solid substrates such as pipes. Preferentially, this multimodal ethylene polymer is a bimodal ethylene copolymer in the form of a blend of two polymers having different molecular weights, the first polymer being an ethylene homopolymer and the second polymer being a copolymer of ethylene with 1-butene or 1-hexene (examples; page 6, paragraph 3). Similar to the patent in suit, these bimodal ethylene copolymers are produced by a two-step polymerisation process comprising two reactors which are operated in series (examples; page 4, paragraphs 3 and 4). Based on this, the board concurred with both parties that D2 was the prior art closest to the claimed subject-matter.

### 2. Distinguishing feature

The parties agreed that the subject-matter of claims 1 and 12 is distinguished from D2 only in that the  $M_w/M_n$  value of the multimodal ethylene copolymer B-1 is

higher. This value is a measure of the breadth of the molecular weight distribution, the higher this value, the broader the molecular weight distribution. Hence, the molecular weight distribution required by claim 1 for multimodal ethylene copolymer B-1 is broader than that in D2.

3. Effects linked to the distinguishing feature

It is the object of the patent in suit to provide polymer coated pipes and a process for their production (paragraph [0001]). Regarding the polymers to be used for coating pipes, the patent in suit describes the synthesis of various multimodal (more specifically: bimodal) ethylene copolymers (paragraphs [0084] and following). The multimodal ethylene copolymers of examples 1 to 5 are according to multimodal ethylene copolymer B-1 of claim 1. The multimodal ethylene copolymer of example 6R is a comparative example.

It was common ground between the parties that the pipe coated with the multimodal ethylene copolymer of comparative example 6R of the patent and the process for its production, respectively, differ from the subject-matter of claims 1 and 12 only with regard to the  $M_w/M_n$  value of the multimodal ethylene copolymer B-1. More specifically, the multimodal ethylene copolymer of comparative example 6R has a  $M_w/M_n$  value of 7. By contrast, claim 1 requires a higher  $M_w/M_n$  value "of from 15 to 50".

Thus in the same way as D2, comparative example 6R differs from the claimed subject-matter by a smaller  $M_w/M_n$  value and thus a narrower molecular weight distribution. In fact, the patent in suit states in paragraph [0090], with respect to the multimodal

ethylene copolymer of comparative example 6R, that it is "*similar to Polyethylene #3 of Example 2 of EP 837915*". Since EP 837915 is the European publication number assigned to (international patent application) D2, the patent in suit essentially states that the multimodal ethylene copolymer of comparative example 6R is similar to polyethylene #3 of example 2 of D2. The copolymer of comparative example 6R thus reflects the closest prior art.

This copolymer can thus be taken into account when deriving a technical effect in relation to D2.

- 3.1 The appellant contested this. It stressed that the copolymer of comparative example 6R and polyethylene #3 of example 2 of D2 had very different MFR<sub>2</sub> values with 384 (patent in suit: table 2) and 492 (D2: page 10, line 37), respectively. In addition, both were considered to be only "*similar*" according to the patent in suit (paragraph [0090], see citation above).

This is not convincing. The copolymers of both the patent in suit and D2 are synthesised by a two-step polymerisation process comprising two reactors which are operated in series. The MFR<sub>2</sub> values referred to by the appellant are those of the low molecular weight ethylene homopolymer component produced in the first reactor. They do not reflect the MFR<sub>2</sub> value of the final multimodal ethylene copolymer. Properties or characteristics of intermediate polymer components, however, are of no relevance in the present case where it is the multimodal ethylene copolymer which is used for coating pipes and not the low molecular weight ethylene homopolymer component.

That the breadth of the molecular weight distribution of the copolymer of comparative example 6R is identical to the one of polyethylene #3 of example 2 of D2 can be deduced from their  $FRR_{21/5}$  values. Like the  $M_w/M_n$  value, the  $FRR_{21/5}$  value is also a measure of the breadth of the molecular weight distribution with higher  $FRR_{21/5}$  values indicating broader molecular weight distributions. Both the copolymer of comparative example 6R and polyethylene #3 of example 2 of D2 have the same  $FRR_{21/5}$  value of 20: the  $FRR_{21/5}$  value of the former can be calculated using the data in table 2 in the patent in suit and the relationship  $FRR_{21/5} = MFR_{21}/MFR_5$ . The  $FRR_{21/5}$  value of the latter is given in D2, table 2. This means that both polymers are identical with regard to the parameter in relation to which a technical effect is to be derived. Under these circumstances, the board accepts that the copolymer of comparative example 6R can be taken into account for comparative purposes as a fair representation of polyethylene #3 of example 2 of D2.

- 3.2 It was also a matter of dispute with what embodiment of claim 1, comparative example 6R has to be compared with:

The patent in suit in examples 1 to 5 describes multimodal ethylene copolymers according to B-1 in claim 1. These copolymers, however, differ significantly from that of comparative example 6R: the copolymers of examples 1 to 5 are produced using 1-hexene as the comonomer and have split ratios of 49/51 to 51/49 (the split ratio being the weight ratio of the polymers of both reactors in the final product). The copolymer of comparative example 6R is produced using 1-butene as the comonomer and has a split ratio of 45/55.

The experimental data D7 describes the synthesis of yet another multimodal ethylene copolymer according to B-1 in claim 1, termed example 7R and having a  $M_w/M_n$  value of 22.9. As regards both the comonomer (1-butene) and split ratio (45/55), the copolymer of example 7R is much more similar to that of comparative example 6R than are those of examples 1 to 5. Based on this, among the copolymers according to B-1 in claim 1, that of example 7R is the more relevant one for a comparison with the copolymer of comparative example 6R.

3.3 A comparison of the copolymers of example 7R (according to claim 1) and of comparative example 6R shows that the former:

- (a) has a higher resistance to environmental stress cracking, as measured by CTL (constant tensile load), namely, 52 h (7R) vs. 29 h (6R)
- (b) shrinks less in width when extruded through a slit die, synonymous to a reduction in "neck-in", as measured as a width of the film after a 110 mm die, namely 78 mm (7R) vs. 76 mm (6R)

3.3.1 The appellant argued that the alleged improvements in environmental stress cracking resistance and neck-in were not to be taken into account for the assessment of inventive step.

Ad (a):

According to the appellant, the copolymers of example 7R and comparative example 6R differed from each other not only with respect to their  $M_w/M_n$  value. They also differed from each other with regard to both their

densities and their molecular weights, each of them having an influence on the environmental stress cracking resistance. Moreover, the fact that different catalysts were used for the production of both polymers could also play a role.

This is unconvincing. Catalysts are generally used only in very small quantities to prevent the residues resulting from the use from affecting the properties of the final reaction product. In addition, the most prominent difference between the copolymers of example 7R and comparative example 6R is the breadth of the molecular weight distribution. The differences between both copolymers as regards other parameters are negligible. In the absence of any tangible data which might potentially cast doubt on this, the board sees no reason to doubt that the breadth of the molecular weight distribution is responsible for the difference in environmental stress cracking resistance.

In the written procedure, the appellant further argued that contrary to the copolymer of example 7R, the copolymers of examples 2 to 5 performed worse regarding their environmental stress cracking resistance. This argument, however, was not relied upon during the oral proceedings. In any case, it is not persuasive in view of the fact that the comparison of example 7R with comparative example 6R is more relevant than that of examples 2 to 5 with comparative example 6R (see point 3.2 above).

Ad (b):

The appellant argued that the improvement in neck-in was only 2 mm. Such a very small difference had to be attributed merely to fluctuations. The polymer of

example 1 for instance had a  $M_w/M_n$  value of 30 and showed a width of 84 mm after extrusion. Although the polymer of example 2 had a broader molecular weight distribution ( $M_w/M_n = 32$ ), its width after extrusion was not larger but instead smaller (80 mm). Consequently, there was no interrelation between the breadth of the molecular weight distribution and the reduction in neck-in. It was also evident (e.g. from the graph in D11) that there was a huge gap between the only comparative example 6R and the examples according to the patent in suit regarding their  $M_w/M_n$  values, namely 7 (comparative example 6R) vs. 22.9 to 35 (examples 1 to 5 and 7R). This shifted the burden of proof for an interrelation between the breadth of the molecular weight distribution and the reduction in neck-in to the respondent.

Again, the board does not find these arguments convincing. The copolymers of examples 1 to 5 and 7R are in accordance with the multimodal ethylene copolymer B-1 in claim 1. Their  $M_w/M_n$  values range from 22.9 (example 7R) to 35 (examples 4 and 5). Each of these polymers shows an improvement in neck-in when compared to the copolymer of comparative example 6R. This is evident from the graph depicted in D11. Given these copolymer examples according to B-1 in claim 1, there is no reason to doubt that other copolymers with, for instance,  $M_w/M_n$  values close to the borders of the  $M_w/M_n$  range in claim 1 would also bring about a similar improvement. This is all the more true as the appellant has not provided any counter-evidence which could cast doubt on the above finding. The lack of, for instance, a (proportional) interrelation between  $M_w/M_n$  values and a reduction in neck-in (see the appellant's argument based on a comparison of examples 1 and 2) is not detrimental to the acknowledgement of this effect since



a reduction in neck-in vis-à-vis the copolymer of comparative example 6R is maintained nonetheless.

- 3.3.2 In summary, the board accepts that the feature distinguishing the subject-matter of claims 1 and 12 from D2, namely, a broader molecular weight distribution of the multimodal ethylene copolymer B-1, is linked to a higher environmental stress cracking resistance of the copolymer and a reduced neck-in during its extrusion through a slit die.

4. Objective technical problem

- 4.1 As is clear from the above, the higher resistance to environmental stress cracking and the reduction in neck-in vis-à-vis D2 result from the fact that the multimodal ethylene copolymer B-1 has a broader molecular weight distribution.

This copolymer B-1 forms part of the coating of the pipe of claim 1. It is also used in the process of claim 12, eventually leading to a coated pipe according to claim 1. The effect linked to the nature of the copolymer B-1, i.e. the higher resistance to environmental stress cracking, therefore needs to be taken into account for formulating the objective technical problem with regard to the subject-matter both of claim 1 and claim 12.

The reduction in neck-in is observed after extrusion of the copolymer melt through a slit die, i.e. during the process which makes use of it. This effect needs to be taken into account for formulating the objective technical problem with regard to the subject-matter of claim 12. It was alleged by the respondent that a reduction in neck-in led to a smoother polymer coating

on the pipe, i.e. that it also led to an improvement of the coated pipe. This allegation, however, was not proven and cannot therefore be taken into account with respect to claim 1.

4.2 Based on the above, the objective technical problems can be formulated as:

- The provision of a coated pipe having a higher environmental stress cracking resistance (claim 1).
- The provision of a process for producing a coated pipe having a higher environmental stress cracking resistance during which process neck-in of the extruded polymer melt is reduced (claim 12).

4.3 The appellant argued that the reduction in neck-in was only relevant when pipes were coated using the winding technique as only this technique required extrusion of the copolymer melt through a slit die. Claim 12, however, was not restricted in that regard and also covered, for example, coating processes in which the polymer melt was extruded through a crosshead circular die (such as in D1, example 4).

This allegation of fact was put forward by the appellant for the first time during the oral proceedings. The respondent explained that the effect of a reduction in neck-in could also be relevant when using other, i.e. not slit shaped, dies. In case this new allegation of fact was admitted, the respondent requested an adjournment of the oral proceedings to have the possibility to consult a technical expert on this matter. In view of the complexity of this newly alleged fact and the lateness of its submission, the

board decided not to admit it into the proceedings pursuant to Article 13(1) and (3) RPBA.

5. Obviousness

5.1 In D2 (page 1, lines 24 to 27), the problem to be solved is phrased as follows:

*"The purpose of the invention is to provide a coating material having good melt coating processability, **low shrinking**, high service temperature range and **good environmental stress cracking resistance**. The invention also strives for efficient coating speed expressed as high winding speed of the extruded material."* (emphases added)

Thus, D2 explicitly addresses one of the objects of the patent in suit, namely, a "good environmental stress cracking resistance". If it is accepted, for the sake of the appellant, that "low shrinking" can be equated to a reduction in neck-in, D2 also explicitly addresses the other object of the patent in suit.

In D2, however, these effects are traced back to the multimodality of the ethylene copolymer, they are not associated with the breadth of its molecular weight distribution. This is evident from the following passages in D2:

*"The present invention is based on the finding, that multimodal ethylene polymer has excellent coating application properties such as good processability and low shrinkage as well as superior environmental stress cracking resistance."* (D2: page 3, lines 1 to 3)

*"It was found, that [...] the mere fact that the ethylene polymer was multimodal, i.e. was the blend of different molecular weight fractions, rendered it totally superior e.g. with respect to the processability measured as winding speed and the environmental stress cracking resistance." (D2: page 6, line 34, to page 7, line 2).*

5.2 As regards the question whether or not D2 links the effects of "low shrinkage" and "good environmental stress cracking resistance" to the breadth of the molecular weight distribution, the appellant pointed to the following sentence (D2: page 5, lines 15 to 17)

*"Thereby, it is advantageous if the **molecular weight distribution** corresponding to said flow rate ratio shows several peaks or a **broad peak** lacking small fractions of extremely low and extremely high molecular weight material." (emphases added)*

and argued that D2 taught a broad molecular weight distribution to be advantageous.

The board does not agree. The above sentence describes peaks and their shapes within a given molecular weight distribution. It describes two cases, one where the molecular weight distribution shows several peaks and another one where it shows only one single broad peak that lacks smaller peaks. This latter case alludes to the situation where "several peaks" have merged into each other to give a "broad peak". In the board's judgement, this sentence should not be read as meaning that a broad molecular weight distribution was advantageous *per se*.

5.3 In summary, there is no teaching in D2 linking a broadening of the molecular weight distribution to improvements relating to the effects mentioned above, i.e. environmental stress cracking resistance and neck-in. Thus, D2 alone would not have led the skilled person to a solution of the above objective technical problems.

The appellant argued that a link between these effects and the breadth of the molecular weight distribution was not even necessary. D2 referred to the breadth of the molecular weight distribution in terms of the flow rate ratio  $FRR_{21/5}$ . According to D2 (page 5, lines 13 to 15), this ratio was preferentially between 10 and 50, more preferentially between 15 and 40. The patent in suit essentially disclosed the same range of  $FRR_{21/5}$  values in its description (paragraph [0057]: "a flow rate ratio  $FRR_{21/5}$  of 15 to 40, more preferably from 20 to 35") which had to correspond to the range of  $M_w/M_n$  values given in claim 1, i.e. "of from 15 to 50". Thus, by merely following the teaching of D2, the skilled person would inevitably have arrived at the invention of the patent in suit.

The board cannot accept the appellant's conclusion drawn from a comparison of the disclosures of the patent in suit and D2. The ranges given in the patent in suit in claim 1 (" $M_w/M_n$ , of from 15 to 50") and the description (" $FRR_{21/5}$  of 15 to 40") do not correspond to one another as is clear from the copolymer of comparative example 6R. This polymer has a  $FRR_{21/5}$  value of 20 (see above). This value falls well within the ranges given in the description of the patent in suit and D2. At the same time, however, this polymer has a  $M_w/M_n$  value of only 7 (see also above), which is clearly outside the range of claim 1.

The copolymer examples in D2 have  $FRR_{21/5}$  values in the range of 16 to 21. As set out above, these copolymers are different from those defined as the multimodal ethylene copolymer B-1 in claim 1 of the patent in suit. The board admits that the range specified in D2 ( $FRR_{21/5} = 15$  to 50) is broader and possibly overlaps with the range of  $M_w/M_n$  values in claim 1. Yet, without a general teaching in D2 associating the breadth of the molecular weight distribution to the effects mentioned above, the skilled person could have but not necessarily would have chosen to increase the breadth of the molecular weight distribution of, for example, copolymer #3 of example 2 of D2 to solve the objective technical problems as formulated above.

5.4 Starting from D2, the appellant also referred to D1 and D3. Both of these documents related to bimodal ethylene copolymers, and the breadth of their molecular weight distributions corresponded to those of the patent in suit:

- D1 (example 4; page 13, line 34, and page 5, lines 34 to 42) disclosed the coating of a steel pipe with a copolymer having a  $FRR_{21/2}$  value of 90. The value of 90 was not the upper limit intended by D1 as was clear from examples 1 and 2 disclosing even higher  $FRR_{21/2}$  values of 104 and 150, respectively. The range defined by these values of D1 comprised the  $FRR_{21/2}$  values of the examples in the patent in suit, the latter ranging from 85 to 128 (derivable from the data in table 2 of the patent in suit and the relationship  $FRR_{21/2} = MFR_{21}/MFR_2$ ).

- D3 (table I, last three lines) disclosed the  $M_w/M_n$  values of its polymers to preferably lie in the range of 20 to 35.

Further, D1 (page 1, lines 9 to 18) disclosed that a broad molecular weight distribution was beneficial with regard to the processability of the polymer and both D1 (e.g. page 10, line 44) and D3 (column 7, lines 27 to 30, and table V) indicated the resistance to environmental stress cracking of their polymers. A combination of D2 with either D1 or D3 would thus have led the skilled person to the invention of the patent in suit without having to apply inventive skills.

This is unconvincing. Although both D1 and D3 characterise at least some of its polymers with regard to their resistance to environmental stress cracking and the breadth of their molecular weight distribution, there is no conclusive teaching in these documents linking a higher resistance to environmental stress cracking to a broader molecular weight distribution. For this reason alone the skilled person starting from D2 would have found no incentive in D1 or D3 to increase the breadth of the molecular weight distribution of, for instance, copolymer #3 of example 2 of D2 to solve the above-mentioned objective technical problems. Although D1 describes a broad molecular weight distribution as being advantageous with respect to processability, it does so in the context of various different applications such as "*producing films, pipes, bottles, cables, or the like by extrusion or blow molding*" (page 1, line 10). It is therefore not self-explanatory and cannot therefore simply be assumed that an improvement of processability as alluded to in D2 would be equivalent to the specific

problem of the patent in suit, namely, the reduction in neck-in.

Thus, an inventive step is to be acknowledged also in view of a combination of D2 with D1 or D3.

## Order

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:



N. Maslin

M. O. Müller

Decision electronically authenticated