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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte YONGHUA ZHOU and LEONARD PINCHUK

Appeal 2011-012369
Application 12/145,704
Technology Center 1700

Before BRADLEY R. GARRIS, CHUNG K. PAK, and
DONNA M. PRAISS, *Administrative Patent Judges*.

GARRIS, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134, Appellants appeal from the Examiner's rejection under 35 U.S.C. § 103(a) of claims 1, 3-10, 13-20, and 26-47 as unpatentable over Kennedy (US 4,946,899, issued Aug. 7, 1990) in view of Wong (US 4,698,394, issued Oct. 6, 1987). We have jurisdiction under 35 U.S.C. § 6.

We AFFIRM.

Appellants claim a polymer (e.g., a thermoplastic or thermoset polymer) prepared from a branched alkene monomer such as isobutylene, an olefin monomer having a pendant benzocyclobutene (BCB) group such as 4-vinylbenzocyclobutene, and (optionally) a glass-forming monomer such as styrene (claims 1, 10, and 32) as well as a method of preparing such a polymer comprising cationically polymerizing the previously mentioned monomers (claim 14).

Representative claims 1, 10, 14, and 32 read as follows:

> 1. A polymer, comprising:
> (a) a plurality of constitutional units that include at least one cationically polymerizable branched alkene monomer, wherein the branched alkene monomer is an isoolefin selected from the group consisting of isobutylene, 2-methyl-1-butene, 2-methyl-1-pentene, 2-methyl-1-hexene, and combinations thereof;
> (b) a plurality of constitutional units that include at least one cationically polymerizable olefin monomer having a pendant benzocyclobutene (BCB) group; and optionally
> (c) a plurality of constitutional units that include at least one glass-forming monomer.
>
> 10. A polymer according to claim 1, wherein the polymer is a thermoplastic polymer.
>
> 14. A method of preparing a polymer comprising cationically polymerizing
> (a) at least one branched alkene monomer;
> (b) at least one olefin monomer having a pendant benzocyclobutene (BCB) group; and optionally
> (c) at least one glass-forming monomer.
>
> 32. A thermoset polymer prepared from:
> (a) a plurality of constitutional units that include at least one cationically polymerizable branched alkene monomer, wherein the branched alkene monomer is an isoolefin selected

> from the group consisting of isobutylene, 2-methyl-1-butene, 2-methyl-1-pentene, 2-methyl-1-hexene, and combinations thereof;
>
> (b) a plurality of constitutional units that include at least one cationically polymerizable olefin monomer having a pendant benzocyclobutene (BCB) group; and optionally
>
> (c) a plurality of constitutional units that include at least one glass-forming monomer;
>
> wherein the polymer has been heated and crosslinked to form a thermoset polymer.

The Examiner finds that Kennedy discloses preparing thermoplastic elastomeric copolymers by cationically polymerizing the claimed branched alkene monomer such as isobutylene and the claimed glass-forming monomer such as styrene but not the claimed olefin monomer having a pendant benzocyclobutene group (*see, e.g.,* Ans. 5). The Examiner points out that Kennedy discloses avoiding the undesirably low glass transition temperatures of similar prior art thermoplastic elastomers by using outer glassy blocks having aromatic groups, that is, by varying the composition of the outer glassy blocks (e.g., blocks of polymerized styrene or styrene derivative; *see* col. 2, ll. 44-52; *see also* col. 3, ll. 19-23) (*see, e.g.,* Ans.5). Concerning the deficiency of Kennedy, the Examiner additionally finds that Wong discloses copolymerizing styrene and other olefins with a monomer containing a benzocyclobutene group (e.g., Appellants' 4-vinyl benzocyclobutene; *see* Wong col. 2, l. 60) in order to obtain a polymer which may be cross-linked at elevated temperatures (i.e., above about 200°C) thereby resulting in a higher glass transition temperature (*see, e.g.,* Ans. para. bridging 5-6).

In light of these findings which Appellants do not dispute, the Examiner determines that "a person of ordinary skill would have been motivated to increase the glass transition temperature of the polymers of Kennedy by copolymerizing the styrene and isobut[yl]ene, as taught by Kennedy, with monomers having a benzocyclobut[e]ne group and then thermally crosslinking the polymer as taught by Wong" (*id.*). The Examiner concludes "[that] it would have been [prima facie] obvious . . . to have made the block copolymers of Kennedy by copolymerizing styrene with monomers having a benzocyclobut[e]ne group, thereby arriving at the presently claimed invention" (*id.*).

Appellants argue that the Examiner has failed to provide an acceptable reason explaining why Kennedy and Wong would have been combined as proposed based upon a reasonable expectation of success (*see, e.g.*, App. Br. 19-21).

Appellants' argument is unpersuasive. We agree with the Examiner that an artisan would have been motivated to provide Kennedy's polymers with desirably high glass transition temperatures by copolymerizing Kennedy's monomers with the claimed monomers having pendant groups as taught by Wong. The artisan would have recognized that so-combining the applied reference teachings would provide Kennedy's polymers with the desirable and predictable improvement of high glass transition temperatures via a polymerization technique (i.e., polymerizing with 4-vinylbenzocyclobutene) taught by Wong to be known in the prior art. Prima facie obviousness is supported by the fact that the resulting polymer would have prior art constitutional units from, for example, isobutylene and styrene as taught by Kennedy and 4-vinylbenzocyclobutene as taught by Wong. *See*

KSR Int'l. Co. v. Teleflex Inc., 550 U.S. 398, 415-16 (2007) ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.").

We are also unpersuaded by Appellants' arguments concerning thermoplastic polymeric claim 10 and thermoset polymer claims 32-44 and 46 (*see, e.g.*, App. Br. 13-14, 18-19). As detailed in the Answer, the proposed combination of Kennedy and Wong would not be contrary to Kennedy's purpose and principles of operation but instead would be desirable by resulting in a thermoplastic polymer which, upon being heated to elevated temperatures as taught by Wong, would cross-link to yield a thermoset polymer having a higher glass transition temperature (Ans. 9-13).

Likewise, we find no convincing merit in Appellants' argument that Kennedy and Wong contain no teaching or suggestion of cationically polymerizing the claimed olefin monomer having a pendant benzocyclobutene group as required by method claims 14-20, 26, 45, and 47 (*see, e.g.*, App. Br. 15-18). The Examiner correctly explains that Wong teaches polymerizing such monomers using polymerization conditions appropriate for styrene (col. 3, ll. 10-11) and Kennedy teaches polymerizing styrene using cationic polymerization conditions (*see, e.g.*, col. 1, ll. 12-14) (Ans. 13-18). We fully agree with the Examiner that these teachings would have suggested cationically polymerizing monomers having pendant groups as required by the method claims based upon a reasonable expectation of success. Further, Appellants' argument is not supported by the referenced paragraphs of the Zhou Declaration of record for the reasons given in the Answer (*id.*). In short, neither Appellants nor the Zhou Declaration addresses with any reasonable specificity the Examiner's position that the

combined teachings of Kennedy and Wong would have suggested with a reasonable expectation of success the cationic polymerization under review.

Finally, Appellants argue that the Zhou Declaration evinces unexpected results based on the successful cationic polymerization of the claimed monomers having pendant benzocyclobutene groups (App. Br. 23). However, as stated above and in the Answer (Ans. 26), the applied reference evidence supports a determination that the cationic polymerization would have been reasonably expected to be successful by those with ordinary skill in this art.

For the above stated reasons, it is our ultimate determination that the Examiner has provided evidence of prima facie obviousness[1] which is not outweighed by Appellants' argument and evidence of nonobviousness. We sustain, therefore, the § 103 rejection of all appealed claims as unpatentable over Kennedy and Wong.

The decision of the Examiner is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED

kmm

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[1] Because it is unnecessary for establishing prima facie obviousness, the structural-similarity issue raised by Appellants' arguments and the Examiner's response to these arguments has not been considered in our disposition of this appeal.