

Sealing Process

The present invention relates to a process for sealing thermoplastic food containers in which the headspace oxygen is removed or reduced.

5 At the present time there are a number of factors which limit the use of thermoplastic containers in the processed food industry. For example, the shelf life of ambient temperature stored food products in thermoplastic containers is currently limited by the oxidative degradation attributed
10 to oxygen either permeating through the body of the container or emanating from the headspace gas. In the majority of cases the headspace oxygen is the most significant cause of the oxidative degradation because the volume of the headspace exceeds the volume of gas permeating through the container
15 during normal periods of storage. This is particularly so in the case of small containers where the headspace represents a large percentage of the total volume of the container.

There are several commonly used methods for eliminating headspace oxygen such as vacuum closing and gas flushing but these
20 are generally slow and inefficient. Initially the headspace is evacuated, usually inside a chamber larger than the food container so that the container can be sealed with a diaphragm whilst still within the vacuum chamber. In the case of gas
25 flushed containers, the whole chamber has to be flushed to atmospheric pressure before sealing can take place and consequently more gas is used than is necessary to fill the headspace: this process is therefore rather slow and expensive because of the high gas consumption.

30 In the case of applications where hot filling is required it is impossible to use the vacuum closing method because of the boiling which occurs at the reduced pressure and which causes subsequent contamination of the seal area. Therefore
35 in hot filling applications, it is necessary to use the con-

tinuous gas flushing process which uses even more gas and is generally less efficient.

We have found, surprisingly, that by using a microporous plastics gas-breathable membrane as an intermediate lidding material before the final sealing of the container, gasses can be extracted from the headspace without contamination of the seal area by the food product and without the necessity of carrying out wasteful gas flushing procedures.

Accordingly, the present invention provides a process for sealing a thermoplastic based food container which comprises sealing the container after filling by an intermediate membrane made of microporous plastics gas-breathable material, extracting gas from the headspace through the intermediate membrane by mechanically deforming the intermediate membrane into the headspace and afterwards sealing the container by a final barrier membrane.

Since the intermediate microporous membrane is mechanically deformable it helps to prevent panelling of the container.

Preferably the container is sealed by the intermediate membrane immediately after filling.

If desired, after gas has been extracted from the headspace, inert gas may be flushed back to atmospheric pressure to the original headspace volume before the final barrier membrane is sealed to the container. The inert gas is a gas which has no detrimental effect on the food product and contains substantially no oxygen, and is preferably nitrogen or carbon dioxide. Both the intermediate membrane and the final barrier membrane may be sealed to the container by conventional means, for example by using a sealing head fitted with a sealing tool.

The container and the intermediate microporous membrane may be made of a variety of plastics materials, for example polyolefins, vinyl polymers, polyamides or polyesters. The polyolefins may be homopolymers, copolymers or filled, for example, filled polyethylene or filled polypropylene. The container and the intermediate microporous membrane may be made of dissimilar materials and, in such cases, the intermediate membrane may be provided with patterned heat seal coatings; for example, the container may be made of polyester and the intermediate microporous membrane may be made of polypropylene coated in the seal areas with a heat seal lacquer.

The porosity to air at atmospheric pressure of the intermediate membrane may be from 6 to 2'500 cc/min, preferably from 200 to 2'000 cc/min and especially from 1'000 to 2'000 cc/min. The pore diameter may be up to 6 μ and preferably from 2 to 5 μ .

The process of the present invention may be used in the following applications:

- 1) Cold-filled non-processed containers;
- 2) Hot-filled containers with or without subsequent pasteurisation;
- 3) Cold- or hot-filled heat-processed containers.

When the product is subjected to a heat-processing treatment, this is carried out after the container has been sealed by the intermediate membrane, the porosity of which prevents excessive inflation of the container without the need for over-pressure.

The gas is extracted from the headspace by mechanically deforming the intermediate membrane into the headspace, thereby forcing the gas out through the membrane, but if desired, both mechanical deformation of the membrane and vacuum suction may be used simultaneously to extract the gas.

The intermediate membrane permits the extraction of gases from the headspace without the risk of the product being sucked out of the container. If desired, removal of the headspace gas may take place up to the point where the intermediate membrane is in contact with the product.

Both the vacuum suction and the gas flush may be carried out by means of a suction head positioned over the container preferably with the outer rim of the head located on the container rim. This ensures a quicker and more efficient extraction and gas flush than with a conventional chamber machine.

After the extraction of gas from the headspace and, if desired, reflushing to atmospheric pressure with inert gas, the final barrier membrane is sealed to the container. This may be a conventional membrane, for example, one made of a foil laminate. In the cases where the container is gas flushed, the final appearance is similar to conventional containers, that is, with a flat foil diaphragm seal, but in the cases where sealing takes place immediately after extraction of the gas, the container has a dished or recessed appearance.

The cycle time of the process depends on such factors as the film porosity, the headspace volume, the extraction technique and the size of the container but is usually from 1 to 10 seconds.

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The process of the present invention may be used on many types of container for example, polypropylene based thermoplastic pots, tubs or trays, polypropylene coated containers, foil alutray or plastics can type
10 containers. The cross-section of the container may be one of several shapes, for example round, rectangular or oval. Food products contained in the thermoplastic containers sealed in accordance with the present invention have an improved shelf life compared with
15 conventional containers.

The present invention will now be further described by way of example with reference to the accompanying drawings in which:

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Figure 1 is a sectional view of a filled container and the lower part of the first sealing head,

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Figure 2 is a sectional view of a filled container and a second head before descent,

Figure 3 is a sectional view of a filled container and the second head after descent,

Figure 4 is a sectional view of a filled container and a second head with its outer rim located on the container rim and

Figure 5 is a sectional view of a filled container with the lower part of a third head after descent.

One embodiment of this invention will now be described with reference to Figures 1 to 3.

10 A thermoplastic based container 1 with a rim 2 comprises a food product 3, an intermediate microporous polypropylene membrane 4 and a headspace 5. A first head 6 is fitted with a sealing tool 7. A second head 8 comprises an inner piston 9, a sealing tool 10, channels 11 and at its lower end a pre-cut
15 formed foil membrane 12.

In operation, the container 1 is initially positioned beneath the first head 6 where the intermediate microporous polypropylene membrane 4 is sealed to the rim 2 in the conventional
20 manner by the sealing tool 7 to confer the normal volume of headspace 5. Afterwards the first head 6 is removed and the container is brought into position beneath the second head 8 which holds the pre-cut formed foil diaphragm 12 at its lower end by means of vacuum suction through channels 11,
25 whereupon the inner piston 9 descends to deform the intermediate membrane 4 and in so doing, forces out the headspace gas until the membrane touches the food product 3. The foil membrane 12 is then sealed to the rim 2 of the container 1 by means of sealing tool 10 while still in contact with the
30 intermediate membrane 4.

A second embodiment of this invention will now be described with reference to Figures 1, 4 and 5.

5 A thermoplastic based container 1 with a rim 2 comprises a food product 3, an intermediate microporous polypropylene membrane 4 and a headspace 5. A first head 6 is fitted with a sealing tool 7. A second head 22 comprises an inner piston 23, a sealing tool 24 and channels 25. A second pre-formed foil membrane 26 lies on top of the container 1 beneath a
10 third head 27 fitted with a sealing tool 28.

In operation, the container 1 is initially positioned beneath the first head 6 where the intermediate microporous polypropylene membrane 4 is sealed to the rim 2 in the conventional
15 manner by the sealing tool 7 to confer the normal volume of headspace 5. Afterwards the first head is removed and the container is moved to the second head 22 which is brought in to a position so that it is located on the rim 2. The gas is extracted from the headspace by vacuum suction through the
20 channels 25 and simultaneously the inner piston 23 descends to deform the intermediate membrane 4 until it touches the food product 3. During this operation the location of the head 22 on the container rim 2 restricts the suction to the area immediately above the container. After the gas has been ex-
25 tracted from the headspace, nitrogen is injected through the channels 25 to return the system to atmospheric pressure. Finally the container is moved to the third head 27 which descends to seal the second pre-formed foil membrane 26 to the rim 2 by means of the sealing tool 28.



Claims:

1. A process for sealing a thermoplastic based food container which comprises sealing the container after filling by an intermediate membrane made of micro-porous plastics gas-breathable material, extracting
5 gas from the headspace through the intermediate membrane by mechanically deforming the intermediate membrane into the headspace and afterwards sealing the container by a final barrier membrane.
2. A process according to claim 1 characterised in
10 that after the gas has been extracted from the headspace and before the container is sealed by the final barrier membrane, inert gas is flushed back to atmospheric pressure to confer the original headspace volume.
3. A process according to claim 1 or claim 2
15 characterised in that the intermediate membrane is made of polypropylene.
4. A process according to any of the preceding claims characterised in that the porosity to air of the
20 intermediate membrane is from 200cc/min to 2000 cc/min.
5. A process according to any of claims 1 to 4 characterised in that the gas is extracted from the headspace by both mechanically deforming the intermediate membrane into the headspace and simultaneously
25 using vacuum suction.
6. A process according to claim 5 characterised in that the vacuum suction and the gas flush are carried out by means of a suction head positioned over the



container with the outer rim of the head located on the container rim.

7. A process according to claim 1 substantially as hereinbefore described with reference to and
5 illustrated by the accompanying drawings.
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