FOREIGN TECHNOLOGY DIVISION

PROCESS FOR IMPROVING THE RESISTANCE OF POLYCHLOROPRENE RUBBERS IN THE PRESENCE OF AGGRESSIVE MEDIA, ESPECIALLY FREEZING AGENTS AND OILS

by

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EDITED TRANSLATION

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The purpose of this invention is to develop a process that
enables the polychloroprene rubbers to resist corrosive materials
especially refrigerants and oils, to be so improved that the
polychloroprene rubbers, preferably in the form of sealing ele-
ments, can be used for moving parts, and to increase the degree
of cross-linking without increasing the cross-linking agent too
much. In accordance with the invention the task was solved by
the fact that chloroprene rubber articles which are cross-linked
chemically with standard cross-linking agents in the well-known
manner were exposed to energy radiation, for example, electronrays or gamma rays in which the dosage amounted to a given
radiation. The energy of the energy-rich radiation must be
matched to the geometric dimensions of the body to be radiated
in such a way that, somewhat homogenous dosage distribution
is attained over the body to be radiated. If necessary, in
order to attain homogenous dosage distribution a multimultid
radiation can be used.
PROCESS FOR IMPROVING THE RESISTANCE OF POLYCHLOROPRENE RUBBERS IN THE PRESENCE OF AGGRESSIVE MEDIA, ESPECIALLY FREEZING AGENTS AND OILS

Adolf Heger and Günther Carius

The invention concerns a method of improving the resistance of polychloroprene rubbers in the presence of aggressive media, especially freezing agents and oils, advantageously when the polychloroprene rubber is used in the form of a sealing element for seals.

As is well-known, polychloroprene rubber is chemically cross-linked by adding cross-linking agents, e.g., mercaptomidazoline. When used in refrigeration engineering to seal against refrigeration agents and oils, i.e., rubber is attacked not only by the freezing agent such as halogenated hydrocarbons in the process of extraction and swelling but it is also greatly affected by the refrigeration machine oils as a result of the swelling. This, then, softens the polychloroprene rubber and its service life is greatly reduced. In the past, this fact has been countered when the refrigeration machine oil which is always found in the refrigeration cycle, is added to the polychloroprene rubber as a softener and in so doing the swelling equilibrium is quickly attained. Refrigeration machine oil as a softener, however, leads to an extraordinary retardation of the vulcanization process and the typical optimal characteristics of polychloroprene rubber are not attained.

Furthermore, by attaining a comparatively high degree of cross-linking and a corresponding thinning of elastic phase, the swelling, causes, for example, by Freon-22 refrigeration machine oil mixtures, is considerably reduced so that at least a reliable seal is guaranteed in connection with dead load cases.

Increasing the degree of cross-linking by increasing the concentrations of the cross-linking agent is, however, limited because an excessive amount of the cross-linking agent leads to faster aging and consequently hardening. In the final analysis elastomers are also only slightly resistant to refrigerant oil mixtures. [Translators note: The following two sentences are incomplete.] Nitrile rubber mixtures are, of course, oil resistant but nevertheless the resistance of the refrigerant for the most part is not sufficient. Polysulfides have a good refrigerant and also oil resistance but the elastic characteristics are unsatisfactory. Even highly fluoridated elastomers which are characterized by a good temperature and solvent resistance, for the most part are not satisfactory with regard to their permanent deformation in refrigerant oil mixtures.

It is also well-known that the characteristics of any elastomers change due to the influence of ionized radiation.

The purpose of this invention is to develop a process that enables the polychloroprene rubbers to resist corrosive materials especially refrigerants and oils, to be so improved that the polychloroprene rubbers, preferably in the form of sealing elements, can be used for moving parts.

The purpose of the invention is to increase the degree of cross-linking without increasing the cross-linking agent too much.

In accordance with the invention the task was solved by the fact that chloroprene rubber articles which are cross-linked chemically with standard cross-linking agents in the well-known
manner were exposed to energy radiation, for example, electron rays or gamma rays in which the dosage amounted to $2 \times 10^7$ to $4 \times 10^7$ rad. The energy of the energy-rich radiation must be matched to the geometric dimensions of the body to be radiated in such a way that a somewhat homogenous dosage distribution is attained over the body to be radiated. If necessary, in order to attain homogenous dosage distribution a multisided radiation can be used.

In accordance to the invention sealing elements that are made of polychloroprene rubbers can be used in connection with refrigerant-oil mixtures in connection with which a real improvement in the service life is attained.

The invention is to be explained in greater detail in the following by means of a sighted example. Sealing rings with a cross-sectional diameter of 5 mm that are made of chemically chain-linked polychloroprene rubbers were subjected to radiation from two sides with electrons of 1 MeV energy level in which the dosage was $3.5 \times 10^7$ rad.

In the following table the characteristics of the radiation chemical cross-linked specimens of polychloroprene rubber are compared with the characteristics of the specimens that were only chemically cross-linked but of the same material prior and following swelling for 168 hours in a freon refrigeration oil mixture at $0^\circ C$.

<table>
<thead>
<tr>
<th>Characteristics of the rubber</th>
<th>Chemically linked</th>
<th>Radiation before swelling</th>
<th>Radiation after swelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elongation at break (%)</td>
<td>94</td>
<td>73</td>
<td>53</td>
</tr>
<tr>
<td>Impact elasticity (%)</td>
<td>50</td>
<td>70</td>
<td>89</td>
</tr>
<tr>
<td>Shore A hardness</td>
<td>60</td>
<td>72.75</td>
<td>23.80</td>
</tr>
<tr>
<td>Mass change (%)</td>
<td>-</td>
<td>10.65</td>
<td>-</td>
</tr>
<tr>
<td>Volume change (%)</td>
<td>-</td>
<td>35.70</td>
<td>-</td>
</tr>
</tbody>
</table>

Patent Claim:

1. Process for improving the resistance of polychloroprene rubbers against corrosive materials, especially refrigerant oils characterized by the fact that chloroprene articles which were chemically chain linked in the well-known manner with standard chain linking agents are subjected to radiation rich rays in which the dosage amounted to $2 \times 10^7$ to $4 \times 10^7$ rad.

2. Process in accordance to claim No. 1 that is characterized by the fact that electron beams were used as the radiation source.

3. Process in accordance with claim No. 1 characterized by the fact that gamma rays were used as the radiation source.

4. Process in accordance with claim No. 1 to 3 characterized by the fact that in order to attain a homogenous dosage distribution rays were used from several sides.