POLYUREA SELF-SEALING TARGET

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Related U.S. Application Data

Provisional application No. 61/681,140, filed on Aug. 8, 2012.

ABSTRACT

A polymer material is adapted to coat a weapons training target that has the ability to self-heal and maintain its useful life significantly longer than conventional targets. The polymer material includes a polyurea formed from a mixture of about 1 part isocyanate to about 1 part polyetheramine. Methods for making the targets include coating a target mold with the polyurea polymer coating.
PRIOR ART

FIG. 2
POLYUREA SELF-SEALING TARGET
CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority of U.S. provisional patent application No. 61/681,140, filed Aug. 8, 2012, the contents of which are herein incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] The present invention relates to targets and, more particularly, to targets that can self-seal to provide multiple use.

[0003] Targets are used by marksmen as training aids. Initial firearms training may be performed with traditional bull's eye targets or paper, plastic or metallic silhouette targets. These targets are useful to train police, soldiers, hunters or other citizens how to aim and shoot but are limited in the number of rounds they can take before they are torn to shreds.

[0004] The useful life of such targets is limited by their tendency to retain holes, crumble or shred under repeated weapons fire, leaving the military and police force with the high cost of frequent replacement.

[0005] As can be seen, there is a need for an improved target material that may be self-sealing and able to withstand bullets passing therethrough without shredding or falling apart.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is a perspective view of a conventional style military target;
[0007] FIG. 2 is a detailed perspective view of the conventional style military target of FIG. 1, after being shot;
[0008] FIG. 3 is a perspective view of a military target coated with a self-sealing polymer according to an exemplary embodiment of the present invention;
[0009] FIG. 4 is a detailed perspective view of the military target of FIG. 3;
[0010] FIG. 5 is a perspective view of the target of the present invention and a conventional target shot at in a side-by-side comparison;
[0011] FIG. 6 is a close-up view of the target of the present invention of FIG. 5;
[0012] FIG. 7 is a perspective view of an alternate target design that can be made by from the target materials and methods of the present invention;
[0013] FIG. 8 is a perspective view of a target backer made with the polyurea polymer of the present invention; and
[0014] FIG. 9 is a perspective view of a long range target backer made with the polyurea polymer of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0015] The following detailed description is of the best currently contemplated modes of carrying out exemplary embodiments of the invention. The description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating the general principles of the invention, since the scope of the invention is best defined by the appended claims.

[0016] Broadly, an embodiment of the present invention provides a polymer material adapted to coat a weapons training target that has the ability to self-heal and maintain its useful life significantly longer than conventional targets. The polymer material of the present invention includes a polyurea formed from a mixture of about 1 part isocyanate to about 1 part polyetheramine. The present invention further provides methods for making these targets.

[0017] More specifically, the polymer coating of the present invention can be a 100% solids, two component polyurea hybrid ceramic putty. The polymer coating of the present invention can be formulated to contain no volatile organic compounds (VOCs) and can have good resistance to inorganic bases, acids and hydrocarbon solvents. The polymer coating of the present invention has fair resistance to oxygenated and chlorinated solvents and has good resistance to hot water up to about 180° F.

[0018] The polymer coating can be a polyurea having the following physical properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method/units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>ASTM D412</td>
<td>2800</td>
</tr>
<tr>
<td>Elongation (%)</td>
<td>ASTM D412</td>
<td>225%</td>
</tr>
<tr>
<td>Tear Strength (PLI)</td>
<td>ASTM D-624</td>
<td>350</td>
</tr>
<tr>
<td>Hardness (shore A)</td>
<td>ASTM D-2240</td>
<td>90</td>
</tr>
<tr>
<td>Abrasion resistance</td>
<td>Excellent</td>
<td></td>
</tr>
<tr>
<td>Viscosity B-side</td>
<td>CPS</td>
<td>500-600</td>
</tr>
<tr>
<td>Viscosity A-side</td>
<td>CPS</td>
<td>500-600</td>
</tr>
<tr>
<td>Ratio A/B</td>
<td>PV</td>
<td>2:1</td>
</tr>
<tr>
<td>Density B-side</td>
<td></td>
<td>1.025</td>
</tr>
<tr>
<td>Density A-side</td>
<td></td>
<td>1.14</td>
</tr>
<tr>
<td>Flash point</td>
<td>ASTM D-56</td>
<td>&gt;725° F</td>
</tr>
<tr>
<td>VOC testing</td>
<td>CAN/ULC-S774 P</td>
<td>&gt;200° F</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td>8.5 lbs/gallon</td>
</tr>
<tr>
<td>Gel time</td>
<td></td>
<td>25-30 seconds</td>
</tr>
<tr>
<td>Tack Free time</td>
<td></td>
<td>10 minutes</td>
</tr>
<tr>
<td>Foot traffic</td>
<td></td>
<td>1 hour</td>
</tr>
</tbody>
</table>

[0019] In some embodiments, the polyurea can be made from various isocyanates and various polyetheramines, each optionally substituted with one or more substituents that may not affect the desired use of the resulting polyurea. Typically, the polymer does not contain a catalyst of filler.

[0020] Referring now to FIGS. 3 and 4, the polyurea polymer coating 14 of the present invention can be used to coat military training targets 10. In FIG. 1, a conventional military target 100 is shown. FIG. 2 shows this target after being struck by bullets shot at the target 100. As can be seen holes 102 are present in the target 100. After use, the target 100 may fall apart and require replacement.

[0021] On the other hand, FIG. 3 shows a military target 10 coated with the polymer coating 14 of the present invention. When shot at by bullets (the same size and from the same distance as that from FIG. 2), as shown in FIG. 4, the bullet holes 12 are barely noticeable, if noticeable at all. The target 10 of the present invention, coated with the polyurea polymer coating 14, can withstand multiple uses, including hundreds of bullet strikes, without developing holes and falling apart as conventional targets do under similar use. The polymer coating may be disposed on the target with a thickness from about 1/8 inch to about 3/8 inch, for example. Of course, other thicknesses can be achieved and used, depending on the desired application.

[0022] Referring to FIGS. 5 and 6, the targets 10 of the present invention were tested in cooperation with the U.S. Army at Fort Knox. As can be seen in the Figures, the conventional “Ivan” target 100 (left-hand side) has several bullet holes cut through the target, causing the target to eventually develop large holes, rip, tear and collapse. The target 10 of the present invention retains its shape and the holes are minimal,
as can be seen from the close-up view of FIG. 6. The U.S. Army testing determined that the targets 10 of the present invention would last 800% longer than the conventional targets 100 in the U.S. Army's inventory. By using the targets of the present invention, not only would material cost be reduced, but the time, labor and effort involved in having personnel replace the current targets can also be significantly reduced.

[0023] Referring to FIG. 7, the targets of the present invention can be made with various molds 20 to provide not only enemy targets but also civilian targets, further enhancing training efforts.

[0024] In some embodiments, the targets of the present invention can be used as a target backing 30, 40, as shown in FIGS. 8 and 9. For example, a standard paper target can be attached to a target backing 30 made with the polymer of the present invention. Shooting ranges often use wood or cardboard target backings, which, over a limited period of time, wear away. The target backing using the polymer of the present invention can last significantly longer, reducing the time between when a user, such as a shooting range customer, has to wait for the target backing to be changed.

[0025] The polyurea polymer coating of the present invention may be used to coat various targets in addition to the military targets shown in the Figures. In addition, the polyurea polymer coating of the present invention could be used to coat other items that may be subject to penetration, where a self-sealing feature may be desirable. The design is only limited by the base target molds, as the polyurea polymer coating can be applied to any number of molds and, once cured, the polyurea polymer target can be easily removed from the mold for use.

[0026] It should be understood, of course, that the foregoing relates to exemplary embodiments of the invention and that modifications may be made without departing from the spirit and scope of the invention as set forth in the following claims.

What is claimed is:
1. A self-sealing target comprising:
   - a polyurea polymer coating formed from an isocyanate and a polyetheramine in a 1:1 volumetric ratio.
2. The self-sealing target of claim 1, wherein the polyurea is formed from a 100 percent solids, two component polymer hybrid ceramic putty.
3. The self-sealing target of claim 1, wherein the polyurea contains no volatile organic compounds.
4. The self-sealing target of claim 1, wherein the target is a military training target.
5. The self-sealing target of claim 1, wherein the polyurea polymer coating is disposed on the target with a thickness from about \( \frac{1}{4} \) inch to about \( \frac{5}{16} \) inch.
6. A method for making a self-healing target, comprising:
   - coating a target mold with a polyurea polymer coating formed from an isocyanate and a polyetheramine in a 1:1 volumetric ratio;
   - allowing the polyurea polymer coating to cure; and
   - removing the self-healing target from the mold for use.
7. The method of claim 6, wherein the target withstands hundreds of bullet strikes without developing holes and falling apart.
8. The method of claim 6, wherein the polyurea polymer coating is disposed on the target mold with a thickness from about \( \frac{1}{4} \) inch to about \( \frac{5}{16} \) inch.
9. The method of claim 6, wherein the polyurea polymer coating is formed from a 100 percent solids, two component polymer hybrid ceramic putty.
10. The method of claim 6, wherein the polyurea polymer coating contains no volatile organic compounds.
11. The self-sealing target of claim 6, wherein the target is a military training target.

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