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OVERSIZED ABRASIVE COATED PRODUCTS

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ABSTRACT OF THE DISCLOSURE

An abrasive coated product, e.g., an abrasive belt or abrasive disc, having on the abrasive face thereof an oversize of at least about 0.5 lb./ream of a highly chlorinated paraffin or mixture thereof having an average chain length of at least 20 carbon atoms said product being characterized by an increased rate of stock removal and a greater total stock removal during prolonged grinding compared to a product lacking said oversize.

BACKGROUND OF THE INVENTION

This invention relates to abrasive coated products and is particularly concerned with novel abrasive coated products provided with an oversize, the oversized product being characterized by reduced loading of the abrasive face, faster cutting, maintenance of a high cutting rate throughout the life of the product, and removal of more stock during the product life.

It has long been a problem in the grinding of metal with abrasive coated products such as abrasive discs and abrasive belts, to maintain cutting efficiency and economically utilize the products for their full lives. In many cases the products have been discarded long before they were actually worn out because the cutting rate had dropped so low that the time and/or work pressure required to satisfactorily remove stock from the workpiece was unfeasible. The reduction in the cutting rate results from several causes. Physical attrition, i.e., wear, of certain of the granules or grits of abrasive may result in their doing little cutting but at the same time preventing contact between other sharper grits and the work. Accumulation of detritus on and between the grits may also prevent contact between the grits and the surface. Further, chemical reaction between the metal and the abrasive may result in deterioration of the grits or bonding of the metal to the grits with their consequent removal or effective dulling.

In many instances some improvement has been obtained by the use of coolants, lubricants, and even in some cases special grinding atmospheres. However, these also present problems either in application or use.

SUMMARY OF THE INVENTION

It has been found that an improved cutting rate and greater total stock removal during the life of abrasive coated products, such, for example, as abrasive belts, is obtained by applying thereto an oversize of a highly chlorinated paraffin wax. The oversize is applied in solution in a volatile solvent on top of the finished, sandsized abrasive product.

DESCRIPTION OF THE INVENTION

As stated above the novel oversize is applied to the surface of the finished abrasive coated product. Substantially all abrasive coated products are made from abrasive coated flexible webs. The latter are produced by applying to a suitable flexible backing, which may be paper, cloth, or other durable material obtainable in roll form, a coating or layer of adhesive, called the "making" coat. Abrasive grain of desired type, grit size, and characteristics is applied to the adhesive coated surface and after removal of loose, unattached grain and drying and/or curing of the

making coat, a further sealing coating or layer of adhesive, called the "sizing" or "sandsize" coat, is applied over the abrasive grain and is subsequently dried and/or cured. After further treatment, for example flexing, of the abrasive coated products such as abrasive belts, abrasive discs, and abrasive sheets or strips are cut therefrom. A wide variety of adhesives are conventionally used both for making coats and sizing coats. In some cases the same adhesive is employed for both making and sizing coats while in other cases different adhesives are used.

It has been found that an oversize application of a highly chlorinated paraffin wax can be used with advantage on abrasive coated articles produced with any of the conventionally employed adhesives. The terms "highly chlorinated paraffin" or "highly chlorinated paraffin wax" as used herein, mean a paraffin; i.e., a saturated aliphatic hydrocarbon, or a mixture of paraffins, with an average chain length of at least 20 carbon atoms which has been chlorinated to a chlorine content of more than 60% by weight and which has after chlorination a melting point of at least about 80° C. As stated above, the chlorinated paraffin is preferably applied as a solution at room temperatures. However, where the adhesive and/or the backing used in the manufacture of the abrasive coated material are not adversely affected by the higher temperature required, the chlorinated paraffin may be applied in molten form. In either case the oversize may be applied either to the web of abrasive coated material or to the abrasive surfaces of flexible abrasive articles such as belts or discs made therefrom. Although spray coating is preferred, the highly chlorinated paraffin may, if desired, be applied by brushing, roll coating, or in other suitable manner. In the following examples the beneficial effect of the novel use of a highly chlorinated paraffin as an oversize is shown by comparative tests.

In the hereinafter described comparative tests of coated abrasives with and without the oversize, abrasive belts approximately 2 in. (approximately 5.1 cm.) x 84 in. (approximately 213.4 cm.) were employed. The test belts to which the oversize was to be applied were weighed and then evenly sprayed with a solution of the chlorinated paraffin in a high-flash aromatic naphtha for sufficient time to coat them with approximately the desired amounts of the chlorinated paraffin. The belts were then dried and weighed again, the amount of weight increase due to pickup of chlorinated paraffin being calculated as the amount of oversize coating in kilograms per sandpaper ream [9 in. (approximately 22.9 cm.) x 11 in. (approximately 27.4 cm.) $\times$480 sheets=330 ft.^{2} (approximately 30.66 m.^{2})]. The chlorinated paraffin used had an average chain length of 24 carbon atoms, an average molecular weight of about 1050, a melting point of above 90° C., and a chlorine content of about 70%.

Abrasive belts with the oversize coating and control belts having no oversize thereon were then compared in grinding a metal workpiece using a repeated grinding sequence of 8 seconds grinding contact followed by 8 seconds out of contact. After predetermined numbers of grinding contacts the metal workpiece was weighed, the cumulative weight loss of the workpiece i.e., the total cut, being thus determined.

EXAMPLE 1

In this group of tests a titanium alloy rod ⅞ in. (approximately 2.22 mm.) in diameter was ground with abrasive belts constructed from an abrasive coated cloth which comprised a drill cloth backing coated with 60 grit silicon carbide abrasive grain using a phenolic (phenol-formaldehyde resole) resin as both making and sizing adhesive. A grinding pressure of 5 p.s.i. (approximately 0.35 kg./cm.^{2}) was employed. In the following table the total cut after specific numbers of grinding contacts is shown, the

figures being averages of the results obtained with a plurality of belts having the average oversize coating weight on a dry basis specified in the first column of the table.

TABLE A

Oversize coating		Total cut in grams after specified number of grinding contacts				
Lbs./ream	Kg./ream (approx.)	10	20	35	60	100
None	None	2.5	4.4	6.9	9.7	12.4
0.5	0.23	2.8	5.2	8.1	12.1	15.5
1.6	0.73	3.3	5.7	8.9	13.7	19.5
3.6	1.63	3.6	6.3	10.1	15.5	23.8
5.1	2.31	3.9	6.7	10.7	16.9	26.3
8.0	3.63	4.1	7.0	11.1	17.9	27.6
11.2	5.08	3.7	6.8	11.1	17.1	26.5

Study of Table A reveals that the total stock removal with the non-oversized belts during the last 40 grinding contacts averaged only 2.7 g., with the belts having only a 0.5 lb./ream oversize coating the stock removal during the last 40 grinding contacts was 3.4 g., while with the belts having an 8.0 lbs./ream oversize coating the stock removal during the last 40 grinding contacts was 9.7 g., more than 250% improvement over the non-oversized belts. The table also shows that with the belts having an 8.0 lbs./ream oversize the average stock removal during the 40 grinding contacts from 21 to 60 was more than 100% greater than the average stock removal during the same number of grinding contacts by the non-oversized belts. It will be seen from the foregoing table that even as small an amount as 0.5 lb./ream of the oversize materially increases both the rate of cut of the belts and the total cut obtained. Increased benefits are obtained with greater amounts of the chlorinated paraffin up to about 8.0 lbs./ream.

EXAMPLE 2

In this group of tests a rod 1 in. (approximately 2.54 cm.) in diameter of high nickel alloy containing substantial chromium and cobalt was ground with abrasive belts constructed from abrasive coated cloth which comprised a drill cloth backing with 120 grit fused aluminum oxide abrasive grain thereon and a phenol-formaldehyde resin as both the making and sizing adhesive. A grinding pressure of 5 p.s.i. was used and the tests were carried on in the manner above-described.

The test results as averages are set out in the following table.

TABLE B

Oversize coating		Total cut in grams after specified number of grinding contacts				
Lbs./ream	Kg./ream (approx.)	10	20	35	60	100
None	None	2.9	4.2	5.7	8.0	10.5
0.6	0.27	3.3	4.6	6.4	8.5	11.6
1.8	0.82	3.1	4.4	6.1	8.2	11.0
3.5	1.59	2.7	3.9	5.3	7.1	9.5
4.4	2.0	2.2	2.7	3.4	4.5	6.3
5.4	2.45	2.0	2.4	2.7	3.0	3.7

The results in the foregoing table show that improvement in the rate of cut and in the total cut obtained with the belts is produced when from about 0.6 to about 1.8 lbs./ream of chlorinated paraffin is employed as an oversize.

EXAMPLE 3

In this set of tests another 1 in. diameter nickel alloy rod of the same kind as that used in the tests of Example 2 was ground with abrasive belts constructed from an abrasive coated cloth which comprised a drill cloth backing with 50 grit fused aluminum oxide abrasive grain held thereon by epoxylated phenolic novolac resin making and sizing adhesive. A grinding pressure of 5 p.s.i. was used and the tests were conducted as described above.

The test results as averages are set out in the following table.

TABLE C

Oversize coating		Total cut in grams after specified number of grinding contacts				
Lbs./ream	Kg./ream (approx.)	10	20	35	60	100
None	None	2.7	4.1	5.7	8.6	12.5
1.1	0.5	3.5	5.5	7.9	10.9	15.0
2.9	1.32	4.1	5.9	7.9	11.1	15.5
6.0	2.72	5.0	6.7	8.7	11.4	15.0
7.8	3.54	4.1	5.9	8.0	10.6	14.5
8.4	3.81	3.9	5.6	7.9	10.7	14.3

The results in Table C show that both a materially increased cut over the lives of the belts and a maintained rate of cut are achieved with the use of a highly chlorinated paraffin oversize.

In the following example fine grit aluminum oxide belts were used on an aluminum workpiece.

EXAMPLE 4

A workpiece formed by bolting together a pair of ¾ in. (approximately 1.90 cm.) x ⅛ in. (approximately 3.17 cm.) aluminum angles was ground with abrasive belts formed from abrasive coated cloth having a drill cloth backing with 240 grit aluminum oxide abrasive grain and epoxylated phenolic novolac resin making and sizing adhesives. Using a grinding pressure of 2 p.s.i. (approximately 0.14 kg./cm.^{2}) the tests were conducted in the same manner as the previously described tests.

Table D shows the test results obtained as averages.

TABLE D

Oversize coating		Total cut in grams after specified number of grinding contacts				
Lbs./ream	Kg./ream (approx.)	10	20	35	60	100
None	None	1.8	3.2	5.0	7.6	11.1
0.6	0.27	2.8	5.0	7.6	11.5	16.9
1.6	0.73	3.0	5.3	8.4	13.0	19.4
2.7	1.23	2.7	4.7	8.0	12.7	18.8
3.3	1.5	2.4	4.5	7.4	11.7	18.4

The results in Table D show that even under a very low work pressure the belts with as small an amount of highly chlorinated paraffin oversize as 0.6 lb./ream produced an increased rate of cut and an increase in stock removal during prolonged grinding of over 50% in comparison with identical belts with no oversize.

It will be understood that the foregoing examples are merely illustrative and that the present invention is of wider utility than is evidenced thereby. While the tests reported above were on abrasive belts, the use of an oversize of a highly chlorinated paraffin also produces improved grinding results with discs and sheets of abrasive coated products. The type of abrasive grain is not important. As shown by the tests, the action of both silicon carbide and fused aluminum oxide, the most commonly employed abrasive grains, was improved by use of the novel oversize both in fine grit sizes and coarse grit sizes. Other abrasive materials are also useful. Although the advantages of the use of the present novel oversize are perhaps most apparent when using strong bonding adhesives such as resins which hold the abrasive grain securely and thus provide a product with a potentially longer life and when grinding metals such as aluminum or titanium which tend to load or glaze the abrasive surface, the invention is applicable to abrasive coated products with other known types of adhesives, such as glue, and to grinding of metals generally.

It will also be understood that, although a chlorinated paraffin containing about 70% chlorine was used in the tests reported above, chlorinated paraffins with a chlorine content as small as 60% can be usefully employed. While products with a higher chlorine content than about 70% are difficult to obtain and expensive they can also be used satisfactorily.

Percentages specified herein are percentages by weight.

What is claimed is:

1. A flexible abrasive coated product which comprises a flexible backing, a making adhesive coat having a plurality of abrasive granules embedded therein, and a sandsize adhesive coat over said abrasive grain, wherein the improvement comprises an oversize coat of a chlorinated paraffin, or a mixture of chlorinated paraffins, with an average chain length of at least 20 carbon atoms, which has been chlorinated to a chlorine content of more than 60% by weight and which has after chlorination a melting point of at least about 80° C., said product being characterized by an increased rate of stock removal and a greater total stock removal during prolonged grinding compared to a product lacking said oversize.

2. A flexible abrasive coated product as set forth in claim 1 in which said oversize coat is in an amount of at least about 0.5 lb./ream or equivalent.

3. A flexible abrasive coated product as set forth in claim 1 in which said making coat and said sandsize coat are resins.

4. A flexible abrasive coated product as set forth in claim 2 in which said making coat and said sandsize coat are resins.

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