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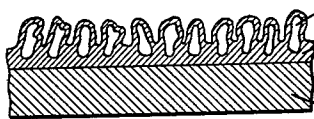
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Fig. 1



ABRASIVE CLOTH COMPRISING
ABRASIVE GRAINS BONDED TO
A CLOTH BACKING BY A RESIN-
BASE BOND INCLUDING AN
ANTI-WELD ADDITIVE.

Fig. 2



ABRASIVE GRAIN
BOND CONTAINING
ANTI-WELD ADDITIVE
CLOTH BACKING

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ANTI-WELD ADDITIVES FOR COATED ABRASIVE BONDS

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This invention relates to improved abrasive products that are characterized by resistance to glazing.

Many metals oxidize at any freshly exposed surface, to form a thin skin of oxide. Such oxides are usually harder than the parent metal. Cutting fluids combat glazing by covering the exposed surface with weld-resisting antioxidant, and also resist loading by forming a film of wax, oil, or other parting agent, on the abrasive belt surface and on the work.

At one time, stainless steel could not be ground economically with abrasive belts. Dry belts would quickly glaze over and become unproductive. The use of improved lubricants has made the grinding and polishing of stainless steel, with coated abrasives, quite economical.

However, many grinding operations must be performed in the absence of cutting oils, lubricants, and the like; and even where these can be employed, glazing remains a serious problem that has a recognized detrimental effect on cutting power and useful life. The particles that form the glaze tend to cover the irregular surfaces of the abrasive grains, diminish the cutting power of the abrasive products, and so shorten its useful life and rate of cut. Glazing of coated abrasive products is particularly noticeable, for example, when steel is ground. The steel particles soften and form a metallic glaze on the surface of the abrasive grains. Lubricants retard glazing, but do not prevent it.

There appears to be an inter-relationship between stock removal temperature and glazing. Factors which tend to raise the local instantaneous temperature at the workpiece-abrasive interface appears to promote glazing, welding, and related chemical reactions. Thus glazing of the coated abrasive belt is self-accelerating in that any increase in temperature at the workpiece-abrasive interface due to friction promotes further glazing. Ultimately, the temperature reaches a point at which the metal workpiece becomes "burned," or discolored due to heat. Factors such as coated abrasive surface speed and pressure affect glazing due to their effect on mechanical breakdown of the abrasive grits and the amount of frictional heat generated. Lubricants, coolants, and other materials which lower instantaneous local stock removal temperatures, reduce glazing tendencies.

Investigation of stock removal with coated abrasives utilizing an inert atmosphere underscores the chemical aspects of glazing and welding of metal to the abrasive. If steel is ground on a coated abrasive belt in an inert oxygen-free atmosphere, the ratio of metal removed to energy input is considerably lower than when a similar operation is performed in the presence of air. At the high instantaneous grinding temperatures, the oxygen in the air apparently forms an oxide film on the chips of steel. Thus, local chemical reactions appear to have a significant relationship to glazing.

One object of the present invention is to provide a coated abrasive product that is characterized by a reduced tendency to become glazed.

Another object of the invention is to provide a coated abrasive product for grinding metals that has a superior cutting rate and a longer useful life than is now considered feasible.

Another object of the invention is to provide a coated abrasive product that exhibits a more uniform abrasive action throughout its useful life.

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Other objects of the invention will be apparent herein-
after from the specification and from the recital of the
appended claims.

In accordance with the present invention, an anti-weld bond is employed for the abrasive particles, that resists the formation of glaze. According to a preferred embodiment of the invention, this bond comprises, for example, a filler and the condensation product of a phenol, an aldehyde, and a water-soluble urea derivative containing sulphur. A coated abrasive product, made according to a preferred embodiment of the invention, comprises a cellulosic backing to which abrasive grains are secured by a bond comprising a filler and a resinous condensation product of a phenol, an aldehyde, and about 20% by weight, based on the initial phenol, of thiourea. The incorporation in the bond of the thiourea, or other organic sulphur-containing compound, imparts to the bond its anti-welding characteristics.

In the drawings:

FIGURE 1 is a plan view of a portion of an abrasive cloth, comprising a cloth backing having abrasive grains attached thereto by a heat-hardened resin bond including as a part thereof an anti-weld additive, in accordance with this invention, and

FIGURE 2 is a cross-section thereof, on an enlarged scale.

To demonstrate the invention, several anti-weld coated abrasive products, and methods of making them, will now be described, together with the results of performance tests conducted with these products, to demonstrate their efficacy.

EXAMPLE 1

Two runs of abrasive coated cloth are prepared, designated E781 and E782 respectively, for identification. Run E781 is made according to conventional manufacturing techniques, to serve as a control specimen to provide a basis for comparison. Run E782 is prepared according to the teachings of the present invention.

A barium octahydrate catalyzed, liquid phenol-formaldehyde resin is prepared that has a formaldehyde factor of 1.6, a low water tolerance, a viscosity of about 200 cps., and that contain about 60% solids by weight. This resin is employed as the bond for the E781 run of coated abrasive.

The bond for E782 is prepared by condensing together phenol and formaldehyde, in the same proportions that were used to prepare the resin described immediately above, together with about 20% by weight of thiourea based on the phenol, using a barium octahydrate catalyst in the amount of about 6% by weight based on initial phenol, to form a resinous product having a viscosity of about 4800 cps. (Brookfield at 25° C.), containing 78.2% by weight solids, having a pH of 7.9, and a water tolerance of about 85%. G.E. gel time at 121° C. is 8.8 seconds.

The backing material that is employed for both runs is a standard, 76 by 48 thread count drill cloth that has been dyed, prestretched and filled in the conventional manner. In both runs, substantially the same general techniques are employed for making the coated abrasive product. The two different resinous condensation products are mixed with calcium carbonate filler and water, to provide a making and sizing bond containing approximately 55% by weight of filler and about 7.7% by weight of water. The making and sizing bond for the E782 run, after addition of the filler and water and as applied to the backing, contains 84.1% by weight of solids, and has an orifice viscosity of 40 $\frac{1}{2}$ at 90° F., and a Brookfield viscosity of 3950 cps. at 90° F. (No. 3 spindle at 20 r.p.m.). The cloth backing is coated with the bond, and 36 mesh crushed

fused aluminum oxide grain is embedded in the making coat. Preferably, electrostatic projection is employed to coat the grain onto the backing. A sandsizing coating of the bond is then applied over the abrasive grain, preferably in an amount equal to approximately one-half the amount of bond that is employed as the making coat. The coated products are then dried and cured.

Drying and curing in each case is effected substantially in accordance with the following schedule: The making coat is dried for three hours at 175° F., and the size coat is dried for one hour at 150° F. and then for an additional period of four hours at 175° F. To cure the bonds the coated products are heated for two hours at 150° F., two hours at 175° F., two hours at 200° F., and then for fifteen hours at 225° F.

The two runs of abrasive coated cloth are now cut, and few belts are made up from each run, for testing. The belts are subjected to a standard mechanical laboratory test, in which a belt is subjected to repeated contacts with a hard metal object under standardized testing conditions as to all variables, such as, for example, belt speed, contact time and pressure, and number of contacts. Three E781 run belts and three E782 run belts are tested in this manner. The results for tests on four of these belts, two belts from each run, are tabulated in Table 1.

TABLE 1

No. of Contacts	Average Cut Per Period, Grs.			
	Belt No. 1 (E781)	Belt No. 2 (E782)	Belt No. 3 (E781)	Belt No. 4 (E782)
15.....	144	165	162	167
15.....	137	145	150	150
30.....	297	300	301	290
60.....	488	546	504	528
Total cut, grs.....	1,066	1,156	1,117	1,135
Total loss in belt weight, grs.....	3.5	7.0	4.0	6.0

In conducting the test on these four belts, the number of contacts used is the standard number of contacts usually employed on belts in this type of test. On the basis of following this standard testing procedure, it becomes obvious that the belts made from the E782 run exhibit superior cutting action, particularly in the final testing period, which leads to the conclusion that these new belts will exhibit longer useful lives than that expected on the basis of past experience with products of the standard type (run E781). The validity of this conclusion is justified by data obtained by testing the third belt from each run, and by modifying the standard test to subject the two remaining belts to an additional number of contacts beyond the number considered adequate for testing a belt made from standard coated abrasive material. A sufficient number of contacts are made in this test substantially to exhaust the useful life of both belts. The data obtained by testing the third belt from each run are summarized in Table 2.

TABLE 2

No. of Contacts	Average Cut Per Period, Grs.	
	Belt No. 5 (E781)	Belt No. 6 (E782)
15.....	152	168
15.....	136	148
30.....	274	307
60.....	501	557
(End of Standard test)		
60.....	414	416
60.....	322	352
60.....	95	270
60.....	-----	120
Total cut, grs.....	1,894	2,338
Total loss in belt weight, grs.....	4.0	14.0

The results in Table 2 demonstrate that the belts made from the run of coated abrasive product made in accordance with the teachings of this invention (E782) have much longer useful life expectancies than the belts made from the standard product (E781). Belt No. 6 exhibited much less evidence of glazing than belt No. 5. Both belts ran fairly clean, but it should be observed that the dirt fell freely from belt No. 6, indicating that the dirt was loosely mechanically bonded, rather than welded to the belt.

Summarizing the results of these tests, the three belts made from run E781 lost grain during these tests, but metal welded on the belts, so that the weight lost by the belts during the test fails to give a true indication of the condition of the belts. The three belts made from the coated abrasive cloth produced in run E782 lost grain, but metal did not weld to these belts, so that these belts exhibited a higher apparent weight loss. There was a marked reduction in the amount of glaze produced on the three belts made from the cloth produced in run E782, as compared with those from run E781. This probably accounts for a major part, at least, of the 25% increased cut obtained by belt No. 6, as compared with belt No. 5.

The coated abrasive cloths are made up into two additional belts to permit further testing with a standard pressure bar test. In this test, a one inch diameter cold rolled steel rod is pushed into the belt as fast as possible, while the belt is driven at a standard grinding speed. In conducting this test, usually, the belt is supported on a rapidly rotating drum, and the steel rod is pressed into engagement with the surface of the belt under a substantially constant load, and so that the rod is generally tangential to the surface of the belt. The belt usually cuts through the bar fairly rapidly. This is a severe test, and one in which the amount of welding that occurs has a critical effect on the test results as well as on the life of the belt. The results of the standard pressure bar test with one belt from each run are summarized in Table 3.

TABLE 3

Belt Made From Run No.	Test Time (Min.)	Cutting Rate, Grs/Min.	Total Cut, Grs. of Metal Removed
E781.....	16 3/4	129.2	2099
E782.....	16	167.9	2687

The superiority of the belt made in accordance with this invention is quite marked. Both belts, at the end of this pressure bar test, had a considerable amount of apparent useful life remaining.

EXAMPLE 2

Further to demonstrate the invention, four more runs are made, which are referred to hereafter as runs (a), (b), (c), and (d), respectively.

In run (a), a standard product is prepared to serve as a control; and this standard product comprises a drill cloth backing of the same type used in Example 1, that is coated with a presize, a making coat, abrasive grains, and a sandsize coat. In run (b), the standard product is modified by substituting for the standard sandsize a sulfur-modified sandsize. In run (c), the standard making coat and sandsize are replaced by a sulfur-modified making coat and sandsize. In run (d), the presize used in run (c) is omitted, but run (d) is otherwise like run (c).

The difference between runs (b) and (c) permits a determination of the relative importance of having the sulfur-containing resin in the sandsize, and in both the making coat and in the sandsize. Runs (c) and (d) provide a basis for comparison between products made according to the invention, one of which, (c) is presized, and the other of which, (d), is not. Run (a) is a standard product, to which the performance of the other runs may be compared.

Run (a).—This run of abrasive coated cloth is pre-

pared by applying a presize to drill cloth of the type used in Example 1. The presize is applied in the manner taught in U.S. Patent 2,805,136, issued September 3, 1957, to Joseph R. O'Neil, Jr., and Halsey W. Buell. A standard phenol-formaldehyde resin is mixed with a calcium carbonate filler to provide a making bond containing about 55 parts by weight, based on the bond, of the filler, and this making bond is applied to the presized backing. Crushed fused aluminum oxide abrasive grain, 36 mesh, is then projected electrostatically to coat the cloth and imbed the grain in the making bond. A sandsize mix is prepared from the same phenolic resin employed in the making bond, mixed with calcium carbonate filler in the ratio of forty parts of resin to sixty parts of calcium carbonate filler, by weight, and is applied over the grain. This coated cloth is cured and provides a standard of comparison or control. In this and in the following runs, standard amounts of materials, as commonly used in the art, are employed.

Run (b).—Another piece of the drill cloth is presized, and coated with a making bond and with crushed fused aluminum oxide abrasive grain (36 mesh), as described in run (a). A sandsize is prepared by forming a resinous condensation product of phenol, formaldehyde, and 20% by weight of thiourea, based on the weight of the initial phenol, and this condensation product is mixed with calcium carbonate as a filler in the ratio of forty parts by weight of condensation product to sixty parts by weight of the filler. This sizing bond is then coated over the grain.

Run (c).—Another piece of the drill cloth is presized in the manner described in run (a) above, and is coated with a making bond having the same composition as the making bond employed in run E782 in Example 1, above. Crushed fused aluminum oxide abrasive grain (36 mesh) is then embedded in the making bond by electrostatic projection, and a sandsize, of the same composition as the sandsize in run (b), is applied over the abrasive grain.

Run (d).—To prepare a coated abrasive cloth of somewhat greater flexibility, a piece of the same drill cloth as in Example 1 is coated with a making bond having the same composition as that in run E782 in Example 1. Crushed fused aluminum oxide abrasive grain (36 mesh) is embedded in the making bond by electrostatic projection, and a sandsize is applied that has the same composition as in run (b).

After these products are cured, they are tested to compare their performance. Based upon extensive testing, it is observed that the products prepared in runs (b), (c), and (d) provide improved grinding performance as compared to the product of run (a), wherever the application is such as to produce glazing of the belt or sheet, because of welding. For heavy duty applications, the presized products are characterized by minimum stripping of the bond from the backing. The product of run (d), in which no presize is employed, has superior flexibility.

As to those applications in which there is mechanical loading of the abrasive cloth, rather than welding, the products of all four runs exhibit substantially the same good performance. There is no evidence of surface contamination of the material being ground, by the sulphur present in the bond. The grinding performance and freedom from glazing of belts from run (b) compare favorably with those of belts from run (c), indicating that glazing (welding) apparently takes place primarily on the sandsize coating or directly on the abrasive particles.

Two other runs of 36 mesh coated abrasive cloth are also prepared, for further comparison, and are identified as runs (e) and (f). The drill cloth backing, that was previously employed, is used again, and is presized as before, for each run.

In the preparation of the resins previously described, a barium octahydrate catalyst has been used, employing 6% by weight of catalyst based on the initial phenol. To determine the effect, if any, of the presence of additional

barium catalyst, a mixture of phenol, formaldehyde, and thiourea is prepared, and 25% by weight, based on the initial phenol, of barium octahydrate is used as a catalyst. The formaldehyde is used in sufficient quantity to provide a formaldehyde factor of 1.6. The amount of thiourea is 20% by weight based on the initial phenol. The condensation product obtained has a viscosity at 25° C. of 4800 cps., contains 76.2% solids, has a pH of 7.9, and has a water tolerance of 85%. It has a G.E. gel time of 8.1 seconds at 121° C. A making and sizing bond is prepared from 40 parts by weight of this condensation product and 60 parts by weight of calcium carbonate filler. The presized drill cloth is coated with the making bond, then with 36 mesh crushed fused alumina grain, and finally a sandsize is applied over the grain. The cured product is identified as run (e).

To determine the effect of a decrease in the amount of catalyst employed, a condensation product is prepared substantially in the manner described immediately above, except that the amount of barium octahydrate catalyst employed is reduced to an amount equivalent to 5% by weight of the initial phenol. The condensation product obtained has a viscosity at 25° C. of 5800 cps., contains 76.8% solids, has a pH of 9.0, has a G.E. gel time of 8.2 seconds at 121° C., and has a water tolerance of 105%. An abrasive coated cloth, identified as run (f), is prepared using this condensation product in the bond, and following substantially the same procedure described above for run (e).

The 36 mesh abrasive cloths produced in runs (a), (e), and (f), are tested by means of the standard laboratory mechanical tests. The following data is observed:

TABLE 4
[Standard test—120 contacts]

Belt from Run	Cut, Grs.	Loss, Grs.
(a).....	944	6.0
(e).....	1,017	7.5
(f).....	1,177	12.5

The belt made from run (f) is somewhat superior in cut to the belt from run (e), but the loss also is greater.

EXAMPLE 3

Resin Sander Discs

Further to demonstrate the invention, several types of resin sander discs are prepared from abrasive coated 0.030" thick vulcanized fiber. To provide bases for comparison, several different types of bonds are employed to secure the abrasive grain to the fiber backing. In each case, except for differences in composition of the making bond, substantially the same manufacturing procedures are followed in making the abrasive coated fiber stock. Thus, for example, in each case, the same fiber backing is employed, and the abrasive grain is 36 mesh crushed fused aluminum oxide. In preparing the making and sizing bond in each case, a finely divided mineral filler is employed. Six specimens of each disc are prepared, for testing.

Disc No. 1 is made with the same base resin for the bond as run E781, to provide a control, for comparison with the discs made in accordance with this invention.

The making bond for disc No. 2 is prepared from the condensation product used in run E782, that contains 20% by weight of thiourea, based on the weight of the initial phenol.

Disc No. 3 is prepared with a making and sizing bond as in run (e), containing 25% by weight, based on the initial phenol, of barium octahydrate as a catalyst.

Disc No. 4 is cut from stock in which the making and sizing bond is identical with that of run (f), in which only 5% by weight of barium octahydrate is employed based on the initial phenol.

The making and sizing bond, for the coated abrasive

stock from which disc No. 5 is cut, is made from a resin containing 2.4 times as much thiourea as the condensation product employed in run E782. To prevent the thiourea from crystallizing during condensation, the thiourea is precondensed with the formaldehyde; and 9% by weight, based on the initial phenol, of barium octahydrate is employed as a catalyst.

The making bond for the coated abrasive stock from which disc No. 6 is cut is prepared from a condensation product prepared from a liquid phenol-formaldehyde resin, to which 20% "sulfads," by weight of the resin, is added. The term "sulfads" identifies dipenthamethylene thiuram tetrasulfide. The amount of available sulphur is 25% by weight.

The making bond employed for the coated abrasive stock for disc No. 7 is made from a liquid phenol-formaldehyde condensation product to which approximately 16.7% by weight of tert-dodecylmercaptan is added.

Six specimens of each of the above seven discs are subjected to standard laboratory mechanical tests to determine their respective relative cutting efficiencies. The data for each numbered disc, that appears in the following table, represents an average of the values obtained in testing each of six specimens of each numbered disc.

TABLE 5

Disc No.	Cut Test		Edge Test	
	Cut, Grs.	Loss, Grs.	Cut, Grs.	Loss, Grs.
1 (control)-----	488	1.8	307	1.2
2-----	540	1.4	308	1.2
3-----	536	1.3	303	1.4
4-----	557	1.3	304	1.9
5-----	473	1.0	305	1.8
6-----	463	1.5	312	2.3
7-----	506	2.0	305	3.9

The foregoing data provides clear evidence that the cutting ability of sander discs, that are made in accordance with this invention, is generally superior.

Six additional specimens of each of discs 1, 2, 5, 6, and 7 were also tested for sanding solder seams. Ordinarily, grinding efficiency on solder is low because considerable mechanical loading of the coated abrasive takes place. The following are the results of these tests, averaged for six specimens for each of the numbered discs.

TABLE 6

Disc No.	Cut, Grs.	Loss, Grs.
1 (control)-----	831	+1.6
2-----	842	+1.6
5-----	822	+0.9
6-----	777	+1.0
7-----	1,856	-1.5

The data in Table 6 indicates that considerable loading occurs, but that the mercaptan-modified bond gives markedly superior performance, exhibiting increased cutting power and considerably less loading.

Considerable variation in the bond composition is possible, within the scope of this invention. Thiourea is a preferred anti-welding agent, since it condenses with formaldehyde and contributes to the strength of the bond. The amount of thiourea preferably is on the order of at least about 2% by weight, based on initial phenol, but may be less, and as is demonstrated, larger amounts of thiourea can be employed. A bond made from a condensation product containing 20% by weight of thiourea, based on initial phenol, produces improvement in anti-welding characteristics on the same order that is obtained from a bond containing 5% or 10% by weight of thiourea based on the initial phenol. For most applications of coated abrasives, for grinding metals, a content of thiourea in the range of about 15% to 20% by weight, based on initial phenol, is preferred, for a barium catalyzed resin.

When a caustic catalyst is employed, there is a tendency for the thiourea to crystallize, so less is used. For example, with a caustic catalyzed resin, approximately 8% of thiourea by weight, based on initial phenol, can be used, preferably precondensed with formaldehyde. When the thiourea is precondensed with the formaldehyde, there is much less tendency for it to crystallize, and 20% by weight of thiourea, based on initial phenol, has been used successfully with a caustic catalyzed resin, to impart anti-welding characteristics to a coated abrasive product, when applied as a sandsize. By way of further example, a caustic catalyzed resin having a pH of 9.2, a G.E. gel time of approximately 9 minutes, and containing about 18 parts by weight of thiourea based on initial phenol, used as a sandsize coat over an animal glue making coat, affords excellent results.

If the phenol-formaldehyde resin is in the 1.3 or 1.4 range, the thiourea must be reacted first with the formaldehyde to form a precondensate, otherwise, the gel time may be undesirably slow. Thiourea reacts preferentially with formaldehyde, and therefore, where there is little or no excess formaldehyde available, the thiourea will tend to leave an insufficient amount to react with the phenol. If enough excess formaldehyde is present, precondensation is not necessary.

While it is preferred to employ thiourea as the anti-welding agent, substantially any other organic sulphur compound can be employed. Thus, for example, such substances can be used as methyl-thiourea, phenyl-thiourea, sulphur derivatives of guanidine, and the like, that may enter into a condensation reaction and function as a part of the bond. Improved anti-welding characteristics are also obtained when the sulphur-containing agent is present in the bond as a simple mechanical additive, in the nature of a filler. For example, many thiocarbamates, mercaptans, and organic sulfides can be employed in this way. The sulfurized organic compounds that are used in extreme pressure lubricants are, in general, satisfactory anti-welding additives. Such compounds include, for example, thiophosphate esters, tetrathio pyrophosphate esters, and other organic sulfur compounds and organic sulfur-phosphorous containing compounds. On the other hand, the inorganic metallic sulfides are generally not satisfactory since when a sufficient quantity is employed to achieve anti-welding characteristics, adhesion to the backing is lost and grinding efficiency drops markedly.

Many organic chlorine-containing compounds also impart anti-welding characteristics in the same manner as the organic sulphur compounds. For example, it has been found that 2,4-dichlorobenzoic acid, when incorporated in a phenolic bond, has advantages in this respect. Other organic chlorine compounds that have considerable promise include chlorophenol, chlorinated bisphenol, chlorinated phosphates such as, for example, trichloro-ethyl phosphates, tris (dibromo-propyl) phosphate, and, as well, material such as triglycol dichloride, and related materials that have a plasticizing action on the bond.

Ordinarily, the use of an anti-welding agent involves a slight increase in manufacturing cost as compared to standard bond material. For this reason, the modified bond preferably is employed only in the sandsize, where most of its effect is exerted. However, both making and sizing coats can be modified if desired. The anti-welding agents are effective in and with all standard bonds, including, for example, glue over resin, resin over glue, and resin over resin. A resin size coat containing an additive according to our invention, without a filler, has been used successfully over glue for a metal cloth, for example. The backing can be paper, cloth, or a laminate of paper plies, cloth plies, or a combination of paper and cloth plies, or other flexible strong material. The abrasive grain may be silicon carbide, garnet, crushed fused alumina, or any other desired grain.

Field results indicate that products made according to the teachings of this invention are superior for grinding alloys for jet engines, particularly with respect to freedom from glazing and improved production. Production improvement on the order of 15% to 20% is obtained. For grinding aircraft turbine blades, an improvement in useful abrasive life on the order of 200% to 300% is obtained. For grinding turbine blades made from a chromium-nickel-molybdenum alloy, the improvement in useful life is on the order of 40% or more. 50 grit abrasive coated cloth has demonstrated superiority for grinding stainless steel, cold rolled steel, jet engine blades and buckets including parts made from titanium, "Nimonic" alloy, and "Inconel" alloy. 80 grit abrasive coated cloth, when employed for grinding heliarc welds on bumper guards, a severe application for any grinding tool, exhibits an increased life of about 25% as compared with the standard 80 grit abrasive coated cloth. Particularly good results are obtained in applications where the products of this invention are employed in conjunction with highly sulfurized oil coolants.

While the invention has been described in connection with specific embodiments thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations following, in general, the principle of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may

be applied to the essential features hereinbefore set forth, and as fall within the scope of the invention or the limits of the appended claims.

Having described the invention, what is claimed is:

1. A coated abrasive article characterized by resistance to glazing and comprising a backing, abrasive particles, and a bond securing said particles to said backing, said bond including a sandsize coat comprising a resinous condensation product of a phenol, an aldehyde, and, as an anti-weld additive, a minor amount up to about 20% by weight, based on the initial phenol, of a water-soluble urea derivative containing sulphur.
2. The article of claim 1, in which said urea derivative is thiourea.
3. The article of claim 1, in which said urea derivative is a sulphur derivative of guanidine.
4. The article of claim 1, in which said urea derivative is an alkyl thiourea.
5. The article of claim 1, in which said urea derivative is methylthiourea.

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