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[54] **METHOD OF PRODUCING COATED ABRASIVE PARTICLES**

[76] Inventors: **Alexander Rose Roy,** 16 Cecil St., Meredale, Johannesburg, Transvaal; **Johannes Daniel Van Schalkwyk,** 904 Total Centre, Braamfontein, Johannesburg, Transvaal, both of South Africa

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[58] **Field of Search** 51/295, 298

[56] **References Cited**

UNITED STATES PATENTS

3,518,068	6/1970	Gillis	51/295
3,528,788	9/1970	Seal	51/295
3,585,013	6/1971	Bruschek	51/295
3,645,706	2/1972	Bovenkerk et al.	51/295
3,650,714	3/1972	Farkas	51/295
3,650,715	3/1972	Brushek et al.	51/295
3,661,544	5/1972	Whitaker	51/295

Primary Examiner—Donald J. Arnold
Attorney, Agent, or Firm—Young & Thompson

[57] **ABSTRACT**

A discrete coated abrasive particle wherein the coating comprises an inner metallic, e.g. nickel, layer and an outer non-metallic protective layer which is preferably a solid resin such as phenolformaldehyde resin is produced by depositing the protective layer on to metal coated particles and the metal coated particles are preferably washed with a cleaning solution immediately prior to the deposition.

8 Claims, No Drawings

METHOD OF PRODUCING COATED ABRASIVE PARTICLES

This invention relates to the coating of abrasive particles.

Resin bond abrasive wheels consist essentially of a metal hub portion around the periphery of which is provided a grinding portion. The grinding portion consists of a plurality of abrasive particles held or embedded in a resin matrix. The abrasive particles are in general either diamond or cubic boron nitride and the resin is generally either phenolformaldehyde resin or a polyimide resin.

Such resin bond abrasive wheels are used for the wet and dry grinding of steel, carbide or like workpieces.

It is well known in the art that the retention properties of the abrasive particles in the resin matrix can be significantly improved by coating the particles with a suitable metal. In the case of wet grinding applications, nickel is the preferred metal, whereas in the case of dry grinding copper is the preferred metal.

The wheel manufacturer does not, in general, coat the abrasive particles, but purchases the metal coated particles from another source for incorporation into wheels. There may well be a significant period, e.g. many months, from the time the particles are coated to the time the coated particles are incorporated in resin bond wheels. During this period, the exposed surface of the metal coating tends to oxidise and these oxides, it has been found, impair the bond formed between the metal and the resin.

According to this invention, there is provided a method for producing a discrete coated abrasive particle in which the coating comprises an inner metal layer and an outer non-metallic protective layer. The protective layer will be substantially inert to normal environmental conditions and will bond readily to the resin matrix of resin bond wheels. Preferably the protective layer is a solid resin. Suitable resins are phenolformaldehyde, epoxy, polyimide, alkyd, non-saturated polyester and polyamide resins.

With this protective layer it has been found the coated particles can be stored for many months without significant deterioration; such particles also bond better to the resin matrix of wheels.

The metal of the inner layer will be any metal suitable in the field of metal clad abrasive particles. As mentioned above, the preferred material is nickel in the case of wet grinding applications and copper in the case of dry grinding applications.

The metal layer will generally be present in an amount of from 20 to 80 percent by weight of the coated particle. The protective layer will generally be present in an amount of from 1 to 3 percent by weight of the coated particle — this provides the particle with a thin continuous protective layer.

According to a more particular aspect of the invention, there is provided a method of producing coated abrasive particles in which the coating comprises an inner metallic layer and an outer non-metallic protective layer, which method includes the steps of providing a batch of metal coated particles, depositing the protective layer on the metal coated particles and recovering the particles as discrete particles each having a metal/protective layer coating.

Preferably, the metal coated particles are treated prior to the protective layer deposition substantially to remove any metal oxides from the exposed metal surface. The deposition should occur as soon after the treatment as possible so as to avoid, as far as possible, any reoxidation of the metal. This treatment will, in general, also remove other impurities such as greases and results in improved bonding between the metal layer and the protective layer.

The treatment is preferably a washing of the particles with a cleaning solution, preferably an alkaline cleaning solution. A suitable cleaning solution is a 10 to 30 percent by weight sodium carbonate cleaning solution. It has been found that elevated temperatures improve the cleaning powers of the solutions. Thus, it is preferable that the cleaning solutions are at or about their boiling points for the treatment.

The invention is illustrated by the following examples.

EXAMPLE 1

35 carats of 80/100 RDA diamond grit coated with a 55 percent by weight layer of nickel (by weight being by weight of the coated particle) was refluxed in a 20% Imperial Zenith Cleaner aqueous solution. Imperial Zenith Cleaner is a commercially available alkaline cleaner having the following composition:

$Na_2 Si O_3$	9.76%
H_2O	24.33%
$Na_2 CO_3$	65.01%
Impurities	Balance

The nickel coated grit was refluxed for half an hour and then removed and washed with distilled water. The particles were dried with analytical reagent acetone and immediately thereafter placed in a solution consisting of 40% phenolformaldehyde dissolved in 60% tetrahydrofurane, percentages being by weight. The particles and solution were agitated by stirring and the resin allowed to deposit on the metal coated particles and set. The amount of solution was so chosen that the total quantity of resin for the 35 carats of diamond amounted to 0.24 grams. With this amount of resin, the particles each had a thin continuous layer of resin amounting to about 3 percent by weight of the coated particle. The particles were recovered as discrete coated particles.

The coated grit as prepared above was incorporated into resin bond abrasive wheels in the usual manner. The wheels were compared with wheels prepared using standard 80/100 U.S. mesh nickel coated grit of the prior art. The results of these comparative tests are tabulated below:

Wheel No.	Treatment	G-Ratio	Percentage Improvement over Standard
PD 964	As in Example 1	126.2	158
PD 960	Standard	81.0	100
PD 1106	As in Example 1	226	137
PD 1107	As in Example 1 tested after two months storage	222	135
PD 1072	Standard	165	100
PD 1117	As in Example 1	272	160
PD 1080	Standard	170	100

As is well known, the G-ratio is a measure of the retentive properties of the diamonds in the resin matrix. The higher the G-ratio the greater the retentive properties. It is clear from the above results that treating the

nickel coated diamond grit in the manner described in Example 1 provides unexpectedly good results, even in cases where the coated grit is stored for a period of two months.

EXAMPLE 2

35 carats of 80/100 U.S. mesh nickel coated grit (nickel coating 55 percent by weight of the coated particle) was washed with Imperial Zenith Cleaner in the same manner as described in Example 1. Immediately after washing the coated grit was placed in a saturated solution of a commercially available polyimide resin in tetrahydrofurane. The mixture was stirred and the resin allowed to deposit on the particles and set. The mixture was filtered and the particles recovered as discrete, nickel/polyimide resin coated particles.

We claim:

1. A method of producing coated abrasive particles for use in the manufacture of a resin-bonded abrasive tool in which the coating comprises an inner metallic layer and an outer solid resin protective layer, which method comprises the steps of providing a batch of particles coated with a metal selected from the group consisting of nickel and copper present in an amount from 20 to 80% by weight of the coated particle, removing metal oxides from the exposed surfaces of the particles, immediately thereafter depositing on the particles, before reoxidation of the exposed surfaces thereof occurs, a protective layer of a solid resin selected from

the group consisting of phenolformaldehyde, epoxy, polyimide, alkyd, non-saturated polyester and polyamide in an amount from 1 to 3% by weight of the coated particle, and recovering the particles as discrete particles having a metal/protective layer coating.

2. A method according to claim **1,** wherein the removal of metal oxides is effected by washing the metal-coated particles with a cleaning solution.

3. A method according to claim **2,** wherein the cleaning solution is an alkaline cleaning solution.

4. A method according to claim **2,** wherein the cleaning solution is a 10 to 30% by weight sodium carbonate solution.

5. A method according to claim **2** wherein the temperature of the cleaning solution is adjacent its boiling point.

6. A method according to claim **2,** and removing the cleaning solution from the particles and drying the particles prior to deposition thereon of said protective layer.

7. A method according to claim **6,** wherein said cleaning solution removal and drying are effected by contacting the particles with acetone.

8. A method according to claim **1,** wherein the deposition of the protective layer is effected by immersing the particles in a solution of said resin in tetrahydrofuran.

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