

CAVELIER

ABOGADOS

www.cavelier.com
cavelier@cavelier.com

EDIFICIO SISKI
CARRERA 4 No. 72 - 35
BOGOTA 8, COLOMBIA

289 210
Teléfono: (57-1) 347 3611
Telefax: (57-1) 211 8650
(57-1) 540 0860
Fax in U.S.A.: (1-305) 381 9660

Señora Jefe de la
DIVISION DE NUEVAS CREACIONES
Superintendencia de Industria y Comercio
E. S. D.

Superintendencia de Industria y Comercio



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Asunto : Solicitud de Patente para **ARTÍCULOS ABRASIVOS
Y MÉTODOS PARA ELABORAR LOS MISMOS**
Solicitante : **SAINT-GOBAIN ABRASIVES, INC**
Clase : B24D 003/028, C08J 005/000
Publicada en : La Gaceta No. 596 Del 30 de septiembre de 2008
Fecha de Solicitud : 27 de julio de 2007

1. Yo, Emilio FERRERO, identificado como aparece al pie de mi firma, actuando como apoderado en el asunto de la referencia, atentamente, solicito se efectúe el examen de patentabilidad de la solicitud en referencia presentada de acuerdo con el Capítulo II del PCT y según lo establecido en el artículo 44 de la Decisión 486 de la Comisión de la Comunidad Andina. Para tal efecto presento junto con este escrito el recibo por valor de \$210.000.00, que corresponde a la tasa fijada según lo dispuesto en la resolución No. 44372 de 26 de diciembre de 2007.

2. Ruego atentamente a la Señora Jefe se sirva ordenar que se anexe este recibo para que se efectúe dicho examen y se continúe con el trámite de la solicitud.

Señora Jefe,

EMILIO FERRERO
T.P.A. No. 31.929

COLO-15324-841-002-6
ASG\SCT\ID-137005\WPC15324
No. M-2008-137005\ASG

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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 07-077023- -00003-0000

FECHA: 29/09/2008 10:24:02 - DEP. INDUSTRIA Y COMERCIO
CALLE 11 - PATENTIBILIDAD - Edificio 2
ACT. 5.35 PETICION

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 08 - 77,456
FECHA : SEPTIEMBRE 29 DE 2008

***** CONSIGNACION *****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
CAVELIER ABOGADOS	CONSIGNACION	BANCO DE BOGOTA	062754387	80756200	29/09/2008	48,040,000.00

***** C O N C E P T O *****

CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	50005-01-01 SOLICITUDES	114 PTC CAP-II EXAMEN DE PATENTIBILIDAD	210,000.00
TOTAL :			\$ 210,000.00

SON: DOSCIENTOS DIEZ MIL PESOS

RESPONSABLE : _____

RECIBO DE CAJA APLICADO AL EXPEDIENTE No. _____

Colo 15 324-841-002-6

DIVISIÓN DE NUEVAS CREACIONES

RADICACIÓN EXPEDIENTE No. 07-77023

EL EXTRACTO DE LA PRESENTE SOLICITUD DE **PATENTE DE INVENCION**

FUE PUBLICADO EN LA GACETA DE PROPIEDAD INDUSTRIAL No **596** DE

FECHA **30 DE SEPTIEMBRE DE 2008** EL TÉRMINO HÁBIL SEÑALADO POR

LA LEY EXPIRA EL **30 DE DICIEMBRE DE 2008**

NOTA: Dentro del plazo de los seis (6) meses siguientes a partir de la fecha de publicación en la gaceta de Propiedad Industrial, deberá solicitar y cancelar el examen de patentabilidad so pena de que la solicitud caiga en abandono, de acuerdo con lo establecido en el Artículo 44 de la Decisión 486/2000.

SE PRESENTARON OPOSICIONES POR PARTE DE TERCEROS.

SI _____

NO X

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United States Patent [19]
Caul

[11] Patent Number: 4,457,766
[45] Date of Patent: Jul. 3, 1984

[54] RESIN SYSTEMS FOR HIGH ENERGY
ELECTRON CURABLE RESIN COATED
WEBS

[75] Inventor: Lawrence D. Caul, Buffalo, N.Y.

[73] Assignee: Kennecott Corporation, Cleveland,
Ohio

[21] Appl. No.: 195,030

[22] Filed: Oct. 8, 1980

[51] Int. Cl.³ B05D 3/06

[52] U.S. Cl. 51/298; 427/44

[58] Field of Search 51/298; 427/44

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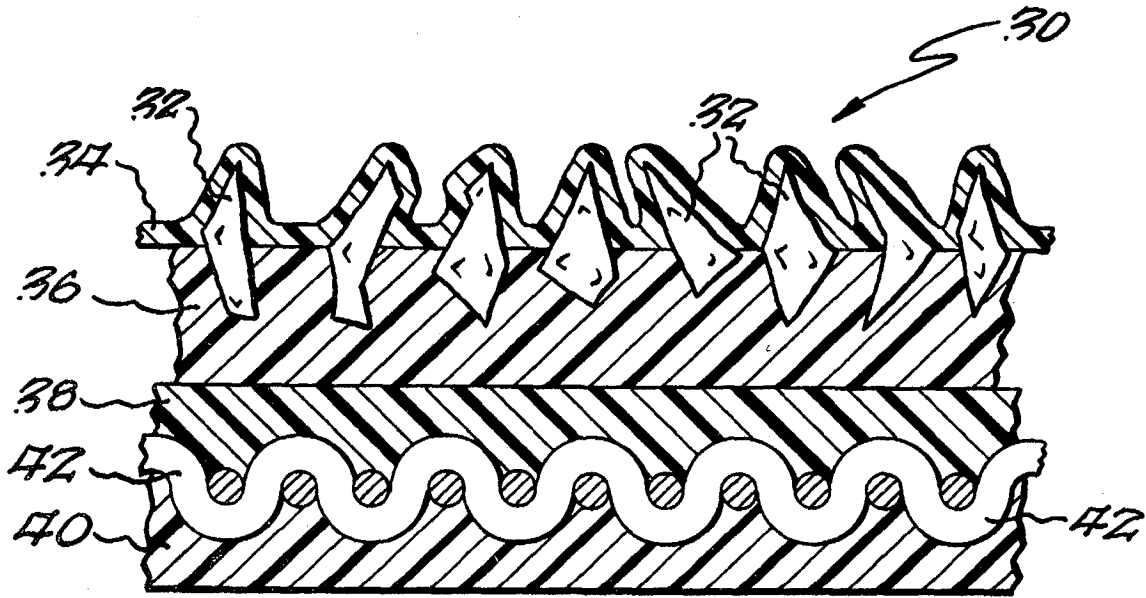
GAF Corporation, Trade Literature, Chemical and
Physical Properties-N-Vinyl-Z-Pyrrolidone.

Primary Examiner—James H. Derrington
Attorney, Agent, or Firm—Harold M. Snyder; R.
Lawrence Sahr

[57] ABSTRACT

The invention provides resin compositions which are particularly suitable for utilization in electron cured coated abrasives. The resin systems of the instant invention have been devised to be particularly suitable for the backing fill of a cloth which is to form the base of a coated abrasive. The formation of a treated base cloth for coated abrasive formation by electron beam curing resins creates a product which in addition to being suitable for immediate formation into a coated abrasive by application of grain is further a product which may be stored for later use or sold to other parties that have need for a waterproof stretch-resistant cloth or that make coated abrasives without doing cloth finishing. The invention also encompasses the formation of electron curing resin systems which are particularly desirable for the make coat and size coat utilized in forming coated abrasives. It is within the system of the invention to utilize the electron radiation curing resins in combination with the conventional heat curing resins.

9 Claims, 2 Drawing Figures



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**RESIN SYSTEMS FOR HIGH ENERGY
ELECTRON CURABLE RESIN COATED WEBS**

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to coated abrasives formation. The invention particularly relates to materials and methods for the formation of coated abrasive materials and the curing of backing coats on cloth or paper which will be used for formation of coated abrasives.

2. Prior Practices

It is known in the coated abrasive art to apply resinous binder and abrasive grains to a paper or cloth substrate which is cured yielding sufficient strength for the following applications, subsequently is a pyrrolidone derivative, for example size coat is applied and the product completely cured. Suitable binders are for example glutelin glue, phenolic resins and, if water-proof papers are desired, polyurethane resins, epoxy resins and alkyd resins, possibly in combination with melamine resins. Special requirements as related to technique, apparatus and time are necessary for the curing process. To avoid destruction of the substrates usually consisting of polyester or cellulose, curing should be effected at a maximum temperature of 120° to 130° C. Rapid curing allowing for the use of a horizontal dryer is difficult, because of the formation of gas bubbles affecting the adhesion of the resin on the substrate. Drying of the coated material generally requires one or several hours, and is therefore carried out in a loop dryer. The loop dryers through which the coated web material is passing, enable a long drying process, but there are also disadvantages, such as the formation of defects where the material is suspended, sagging of the binder and changing of the grain position due to the vertical suspension, variation of temperature and the resulting inconsistent crosslinking of the binder produced by the necessary slow air circulation.

There are several disadvantages of the predominant commercial practice for forming coated abrasives. There are several curing steps in the typical process for formation of cloth-backed abrasives. The major areas of production may be considered as first the cloth treatment to prepare the base cloth for application of abrasives and second the making of the coated abrasives using the previously prepared base cloth. The base cloth is coated with at least one backing coat of resin which impregnates the cloth with resin and fills interstices in the back of the cloth. The backing cloth is also coated with at least one face coat that fills interstices of the cloth on the side where abrasive grain is placed. The face coat or coats of the backing cloth also aid in adhesion of the coat containing the grains onto the cloth.

The second major area of coated abrasive drying is the drying of the make coat which contains the grain and curing the size coat which is an overcoat placed onto the coated abrasive after the grain is at least partially adhered onto the backing by the make coat. In some instances, pre-size coat(s) are applied prior to the make coat. The drying of the presize make and size coats as set forth above generally is done in a lengthy loop dryer that requires a tremendous amount of floor space and energy. Further the larger dryers where the curing takes place over a long period are difficult to completely control for accurate temperature. There also is the problem of the resin and grain shifting posi-

tions during curing because of the long hang times in the uncured form.

It has been suggested in the U.S. Pat. No. 4,047,903, Hesse et al, that the formation of coated abrasives be carried out with at least one layer of resin being cured by electron beam. However, there has remained a need for apparatus which would allow the commercial exploitation of electron beam curing. Hess et al does not set forth apparatus that would allow the continuous formation of coated abrasives. There are extensive difficulties in commercial exploitation of electron beam curing. Selection of resins suitable for electron beam curing of all resin coats utilized in formation of coated abrasives is difficult.

When forming coated abrasives, normally relatively thick coats of resin compared with prior uses of the electron beam are utilized. The resins necessary also are very sticky prior to being completely cured. Therefore, multiple path systems such as disclosed in some prior electron beam curing systems such as U.S. Pat. No. 3,022,543 are not satisfactory since if the resins touch a roller the system usually will gum-up and not perform.

Therefore, there remains a need for a system of electron beam curing resins which will allow formation of good quality coated abrasives in a low-cost commercially satisfactory manner.

BRIEF DESCRIPTION OF THE INVENTION

It is an object of this invention to overcome disadvantages of the prior methods for forming resin coated webs of paper and cloth.

It is a further object of this invention to overcome disadvantages of the prior methods for forming coated abrasives.

It is an additional object of this invention to provide electron beam curable resins for back coats on cloth for use in coated abrasives formation.

It is another object of this invention to provide improved face coats on cloth for use in coated abrasive formation with electron beam curing.

It is another further object of this invention to provide improved make coats for use in forming electron beam curable coated abrasives.

It is another further object of this invention to provide a system of electron beam curing in a continuous manner for coated cloth and coated abrasive materials.

It is an additional further object of the invention to provide improved continuous uniform coating of backing materials for coated abrasives.

It is an additional object of this invention to provide electron beam curing resin systems with good adhesion to backing materials.

It is a further object of the invention to provide an improved resin system for electron beam curing of the size coat for coated abrasives.

It is again another object of this invention to provide resin systems suitable for continuous make-coating and abrasive grain application to webs in apparatus for electron beam curing in the formation of coated abrasives.

It is another object of this invention to provide uniform continuous coated abrasive materials.

These and other objects of the invention are generally accomplished by providing resin compositions which are particularly suitable for utilization in electron cured coated abrasives. The resin systems of the instant invention have been devised to be particularly suitable for the backing fill of a cloth which is to form the base of a coated abrasive. The formation of a treated base

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Among additives suitable for the resin systems of the instant invention are those designed to act as surfactants, pigments for colors and suspending agents. A preferred suspending agent has been found to be fumed silica, preferably in about 20 millimicron particle size, as such material gives good rheological properties. Any suitable dyes or pigments may be utilized to color the coated abrasive by the desired amount.

In formation of both the face and back coats of the invention, the oligomer and diluent are mixed in a ratio of about 50 to about 90% oligomer to about 10 to about 50% diluent. A preferred range of diluent has been found to be about 10 to about 30% by weight of the oligomer for desired flexibility and hardness. The amount is selected so as to give the desired viscosity for application of the oligomer by whatever method of application is utilized and also to give the required flexibility and hardness.

The amount of filler in the face and back coat is determined in respect to the mixture of oligomer and diluent. Generally between about 30 and about 100 parts by weight of filler are utilized per 100 parts by weight of the oligomer and diluent system. The surfactant, suspending agent and pigments are generally used in very small amounts and at the minimum which is effective to give the colorant and dispersant properties desired.

The amount of face fill necessary for each substrate is best determined by looking to the properties desired in the final product. In the instance of 17 pound per ream polyester substrate, it has been found that between about 25% and about 60% of the fabric weight should be applied as a face fill coat. For the same 17 pound polyester fabric, a back fill of about 10% to about 30% by weight of the polyester has been found to be suitable to produce a filled cloth of excellent flexibility, wear and stretch resistance.

The amount of the make and size coats applied to the substrate is whatever is sufficient to hold the abrasive particles.

The methods of applying the coatings of the invention may be selected from those conventional in the coated abrasive art. Among typical methods are roll coating from a transfer roll and doctor blade coating. A preferred method has been found to be press roll or direct roll coating as this is easy to control.

In the size coat, active fillers may be utilized that aid in cutting. Among such fillers for utilization in the size coat are cryolite cutting aids which increase the life of the abrasive. Typical other cutting aids are potassium fluoborate, feldspar, sulfur and iron pyrites.

The amount of radiation from an electron radiation source utilized to cure the instant resin systems is selected to provide complete cure. First coats may not need complete cure. A cure of the back and face coats at 300 kilovolts for a 1 megarad dose to provide sufficient cure with application of the radiation directly onto the wet surface. The make and size coats for the resin systems of the invention at the about 20 mils thickness utilized have been found to be sufficiently cured at 500 kilovolts for a 5 megarads dose from either the face or through the backing. The total voltage requirement is regulated to vary the depth of penetration of the electron beam or other electron radiation source.

The resin systems of the instant invention may be utilized for coating with any suitable source of electron radiation and coating apparatus. A suitable apparatus is disclosed in copending and coassigned application entitled Apparatus for Electron Curing of Resin Coated

Webs, inventor Alton Miller, filed as Ser. No. 172,722 on July 28, 1980.

The following examples illustrate the formation of a coated abrasive in accordance with preferred forms of the instant invention. Parts and percentages are by weight unless otherwise indicated. A ream as utilized in the description and Examples is 480 sheets of 9 inches by 11 inches.

EXAMPLES

EXAMPLE 1

This Example will illustrate the formation of a coated abrasive utilizing the EB cured resins of the invention in each coat of the abrasive and backing material.

There is provided a sateen polyester cloth in a weave of 103×40. This means that there are 103 threads per inch in the running direction and 40 threads per inch in the crossing direction. The polyester has been heat treated to provide a fabric with very low shrink and stretch properties.

A face fill coating was applied to the cloth side with the predominance of fill threads. The face fill ingredients were as follows:

CLASS	COMPOSITION	AMOUNT
Oligomer	Acrylated-urethane (Uvithane ® 783 Thikol Corporation)	4064 grams
Diluent	N-vinyl-2-pyrrolidone	3800 grams
Filler	calcium carbonate of specific gravity of about 2.74 with an average particle size of between about 17 and about 25 microns as measured at the 50% point on a sedimentation curve. Not over 35% by weight remaining on a 270 mesh screen having an opening of 53 microns.	3600 grams
Surfactant	ethoxylated alkyphenol (Igepal ® surfactant GAF Corporation)	56 grams
Suspending agent	fumed silica (Aerosil 200)	60 grams
Colorant	red pigment (P.D.I. 1501) Pigment Dispersions Inc.	10 grams

The face fill coating was applied to a continuous polyester material of 17 pounds per ream weight as set forth above by a knife at a rate of about 11 pounds per ream in a continuous coating and electron beam curing device such as illustrated in the above-referenced copending application Ser. No. 172,722 filed July 28, 1980, entitled Apparatus for Electron Curing of Resin Coated Webs, which has been incorporated by reference. The layer is partially cured to a non-tacky state at about 300 kilovolts at a speed of about 20 feet per minute for a megarad dose of 0.8 megarads.

After the face fill was partially cured, the cloth having the cured face fill coat was repositioned for application of a back fill coat. The back filled coat had a radiation curable resin system coating as follows:

CLASS	COMPOSITION	AMOUNT
Oligomer	diacrylate ester of a bisphenol A type epoxy resin (Celrad ® 3600 Celanese Chemical Co.)	2000 grams
Diluent	N-vinyl-2-pyrrolidone	2000 grams
Filler	trimethylolpropane triacrylate (TMPTA)	780 grams
Filler	calcium carbonate (same as in face fill)	5000 grams
Surfactant	FC430 (Fluorocarbon from	10 grams

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CLASS	COMPOSITION	AMOUNT
Colorants	3M Company)	
	brown (PDI 1705)	500 grams
	black (PDI 1800)	50 grams
Suspending Agent	from Pigment Dispersions Inc.	
	fumed silica, Aerosil 200, average primary particle size 12 millimicron	100 grams

CLASS	COMPOSITION	AMOUNT
Pigment	black pigment (Pigment Dispersion Inc. P.D.I. 1800)	100 grams

This resin system was roll coated by direct roll application onto the back of the previously face filled roll. The application rate was at a rate of about 5 pounds per ream. The coating was then cured at 300 kilovolts at a speed of 20 feet per minute for an exposure of about 0.8 megarads. After curing, the back and face coated cloth was removed and again placed in the device as the dispensing roll.

A make coat was prepared for application to the prepared backing material. The make coat has the following composition:

CLASS	COMPOSITION	AMOUNT
Oligomer	acrylated epoxy resin (Celrad ® 3500 - Celanese Chemical Co.)	5530 grams
Diluents	N-vinyl-2-pyrrolidone	1273 grams
	isobornyl acrylate available from Rohm and Haas Company as Monomer QM-589	1661 grams
Filler	acrylic acid	288 grams
	calcium carbonate (same composition as in the face fill coat)	4000 grams
Surfactant	FC-430 fluorocarbon	10 grams
Suspending agent	Aerosil 200	150 grams
Colorants	red pigment (P.D.I. 1501 Pigment Dispersions, Inc.)	270 grams

The make coat was applied at a rate of about 15.7 pounds per ream at an application speed of about 20 feet per minute. The grain was applied at a rate of about 72 pounds per ream using alumina grain of particle size 36 grit. The curing was carried out at 500 kilovolts to give a treatment of about 5 megarads. Cure was carried out by electron beam through the backing rather than directly onto the grain. The backing having the make coat and abrasive grain thereon was removed and placed in position for application of the size coat.

The size coat of the following composition was prepared for application onto the make coat and grain.

CLASS	COMPOSITION	AMOUNT
Oligomer	Celrad ® 3600 (further identified in the back coat listing above)	5210 grams
Diluent	isobornyl acrylate (further identified in the make coat listing above)	1500 grams
	NVP (further identified in the face fill listing above)	1500 grams
	TMPTA (further identified in the listing under back fill above)	1000 grams
	calcium carbonate (further identified in the face fill listing above) filler	
Cutting aid	cryolite (95% through 325 U.S. mesh screen all through 100 U.S. mesh)	8000 grams
Suspending agent	Aerosil 200	100 grams

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The size coat was cured at 500 kilovolts at a speed of approximately 20 feet per minute past the electron beam. The curing dose was about 5 megarads dose from the face side.

The abrasive material was tested and found to provide coating performance at least equal to the presently available alumina abrasives formed on the same polyester backing material.

EXAMPLE 2

The polyester backing material having a face fill and back fill coat as formed in Example 1 is utilized to form a coated abrasive utilizing conventional waterproof heat curable make and size coats. The make coat is of the composition:

CLASS	COMPOSITION	AMOUNT
Phenolic Resin	Phenol-formaldehyde resole 550 cps. at 70% solids	10,000 grams
Filler	Calcium carbonate (same as Example 1)	10,000 grams

The size coat is of a conventional heat curing resin:

CLASS	COMPOSITION	AMOUNT
Phenolic Resin	Phenol-formaldehyde resole 500 cps. at 70% solids	8,100 grams
Cutting Aid	Cryolite (same as Example 1)	9,900 grams
Pigment	Carbon black dispersion	100 grams

This product exhibits good coated abrasive properties, comparable with the conventional products.

EXAMPLE 3

The process of Example 1 was repeated except that the back fill coat was formed utilizing a conventional heat curable acrylic latex resin formed of 70 parts of heat curable latex (Rohm & Haas AC 604-46% latex solids) and 30 parts calcium carbonate (same composition as Example 1).

The product was a satisfactory coated abrasive with good cutting and life properties.

EXAMPLE 4

The process of Example 1 was repeated except that a heat curing make coat of phenolic resin composition below was substituted for the electron beam curable coat of Example 1.

CLASS	COMPOSITION	AMOUNT
Phenolic Resin	Phenol-formaldehyde resole 550 cps. at 70% solids	10,000 grams
Filler	Calcium carbonate (same as Example 1)	10,000 grams

A satisfactory coated abrasive was produced.

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US005833724A

United States Patent [19]
Wei et al.

[11] **Patent Number:** **5,833,724**
[45] **Date of Patent:** **Nov. 10, 1998**

[54] **STRUCTURED ABRASIVES WITH ADHERED FUNCTIONAL POWDERS**

[75] Inventors: **Paul Wei**, Amherst; **Gwo Shin Swei**, East Amherst; **Wenliang Patrick Yang**, Ballston Lake; **Kevin Bruce Allen**, Latham, all of N.Y.

[73] Assignee: **Norton Company**, Worcester, Mass.

[21] Appl. No.: **927,611**

[22] Filed: **Sep. 11, 1997**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 892,494, Jul. 14, 1997, which is a continuation of Ser. No. 782,013, Jan. 7, 1997, abandoned.

[51] Int. Cl.⁶ **B24D 3/34**

[52] U.S. Cl. **51/307; 51/295; 51/308; 51/309**

[58] Field of Search **51/293, 297, 307-309, 51/295**

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,252,683	8/1941	Albertson	51/298
2,292,261	8/1942	Albertson	51/298
5,014,468	5/1991	Ravipati et al.	51/296
5,090,968	2/1992	Pellow	51/293
5,152,917	10/1992	Pieper et al.	51/309
5,304,223	4/1994	Pieper et al.	51/293

FOREIGN PATENT DOCUMENTS

2-83172	3/1992	Japan
4-159084	6/1992	Japan

Primary Examiner—Deborah Jones

Attorney, Agent, or Firm—David Bennett

[57]

ABSTRACT

Coated abrasives suitable for very fine abrading applications can be obtained by depositing a layer of a formulation comprising abrasive grits, fillers, grinding aid, additives and a binder resin on a substrate in the form of a structured abrasive and then adhering to the surface of the structured abrasive a functional powder.

18 Claims, No Drawings

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5,833,724

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STRUCTURED ABRASIVES WITH ADHERED FUNCTIONAL POWDERS

This application is a continuation-in-part of application Ser. No. 08/892,494 filed Jul. 14, 1997 which is a continuation of 08/782,013 filed on Jan. 7, 1997 now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to the production of structure abrasives on substrates in a form useful for fine finishing of substrates such as metals, wood, plastics and glass.

The proposal to deposit generally isolated structures such as islands or ridges of a mixture of a binder and abrasive material on a backing material to form so-called "structured abrasives", has been known for many years. If the islands or ridges have very similar heights above the backing and are adequately separated then, (perhaps after a minor dressing operation), use of the product will result in reduced surface scratching and improved surface smoothness. In addition the spaces between the islands provide a route by which swarf generated by the abrasion can be dispersed from the work area and coolant can circulate.

In a conventional coated abrasive, investigation of the grinding surface reveals that a comparatively small number of the surface abrasive grits in an active abrading zone are in contact with the workpiece at the same time. As the surface wears, this number increases but equally the utility of some of those abrasive grits may be reduced by dulling. The use of structured abrasives has the advantage that the uniform islands wear at essentially the same rate such that a uniform rate of abrasion can be maintained for longer periods. In a sense the abrading work is more evenly shared among a larger number of grinding points. Moreover since the islands comprise many smaller particles of abrasive, erosion of an island uncovers new, unused abrasive particles which are as yet undulled.

One technique for forming such an array of isolated islands or dots that has been described is that of the rotogravure printing. The technique of rotogravure printing employs a roll into the surface of which a pattern of cells has been engraved. The cells are filled with the formulation and the roll is pressed against a surface and the formulation in the cells is transferred to the surface.

In U.S. Pat. No. 5,014,468 a technique for producing structured abrasives is described. In the process a binder/abrasive formulation is deposited from rotogravure cells on a roller in such a way that the formulation is laid down in a series of structures surrounding an area devoid of abrasive. This is believed to be the result of depositing less than the full volume of the cell and only from the perimeter of each cell, which would leave the ring formations described.

The problem with the rotogravure approach has therefore always been the retention of a useful shape to the island. To formulate an abrasive/binder mixture that is sufficiently flowable to be deposited and yet sufficiently non-flowable such that it does not slump to an essentially uniform layer coating when deposited on a substrate has proved very difficult.

Chasman et al., in U.S. Pat. No. 4,773,920 disclosed that using a rotogravure coater, it is possible to apply a uniform pattern of ridges and valleys to the binder composition which, when cured, can serve as channels for the removal of lubricant and swarf. However beyond the bare statement of possibility, no details are given that might teach how this might be carried out.

In U.S. Pat. No. 4,644,703 Kaczmarek et al. used a rotogravure roll in a more conventional fashion to deposit an

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abrasive/binder formulation to deposit a layer that is then smoothed out before a second layer is deposited by a rotogravure process on top of the smoothed-out first layer. There is no teaching of the nature of the final cured surface.

In U.S. Pat. No. 5,014,468 (Ravipati et al.) it was proposed to use an abrasive/binder mixture having non-Newtonian flow properties and to deposit this mixture by a rotogravure technique on to a film. In this process the mixture was deposited from the edges of the rotogravure cells to produce a unique structures with deposits of reducing thickness with distance away from the surface surrounding areas devoid of the mixture. If the cells are sufficiently close together, the surface structures can appear interlinked. This product has proved very useful, particularly in ophthalmic fining operations. The process is very useful but it has a potential problem with increasing build-up of material in the cells of the rotogravure roll such that the deposition pattern can change slightly during a protracted production run. In addition the nature of the process is such that it is limited to formulations containing relatively fine abrasive grits, (usually less than 20 microns).

Another approach to making structured abrasives is provided by depositing an abrasive/binder mixture on a substrate surface and then imposing a pattern comprising an array of isolated structures on the mixture by curing the binder while in contact with a mold having the inverse of the desired patterned surface. This approach is described in U.S. Pat. Nos. 5,437,754; 5,378,251; 5,304,223 and 5,152,917. There are several variations on this theme but all have the common feature that each structure in the pattern is set by curing the binder while the composite is in contact with a molding surface.

The present invention presents a technique for producing structured abrasives with particularly attractive options leading to more aggressive abrasion that are well adapted to the treatment of a wide range of substrates while being adapted to yield fine finishes for protracted periods of operation at a substantially uniform cut rate.

GENERAL DESCRIPTION OF THE INVENTION

It has now been found that a structured abrasive having a functional powder adhered to the surface provides a wide range of advantages over the structured abrasive alone.

In the present application the term "functional powder" is used to refer to finely divided material that modifies the abrasive qualities of the structured abrasives to which it is applied. This can be as simple as making the structured abrasive cut more aggressively or reducing the buildup of swarf or static charge on the surface. Some functional powders can additionally serve as a releasing agent or a barrier between the resin formulation and the embossing tool, reducing sticking problems and allowing improved release. Included under the heading of "functional powders" are fine abrasive grits, grinding aids, anti-static additives, lubricant powders and the like. By "finely divided" we mean that the individual particles of the powder have an average particle size, (D_{50}), less than about 250 micrometers such as from 1 to 150 micrometers and more preferably from 10 to 100 micrometers.

The present invention also comprises a process for the production of a structured abrasive comprising a pattern of abrasive/binder composites adhered to a backing material said process comprising:

- (a) depositing a slurry formulation comprising abrasive grits (and optionally fillers, grinding aids, and other additives), and a curable resin binder on a substrate in a continuous or patterned manner,

248 271

5

ing: coupling agents, such as silane coupling agents, for example A-174 and A-1100 available from Osi Specialties, Inc., organotitanates and zircoaluminates; anti-static agents, such as graphite, carbon black, and the like; suspending agents, viscosity modifiers such as fumed silica, for example Cab-O-Sil M5, Aerosil 200; anti-loading agents, such as zinc stearate; lubricants such as wax; wetting agents; dyes; fillers; viscosity modifiers; dispersants; and defoamers.

Depending on the application, the functional powder deposited on the slurry surface can impart unique grinding characteristics to the abrasive products. Examples of functional powders include: 1) abrasive grains—all types and grit sizes; 2) fillers—calcium carbonate, clay, silica, wollastonite, aluminum trihydrate, etc.; 3) grinding aids—KBF₄, cryolite, halide salt, halogenated hydrocarbons, etc.; 4) anti-loading agents—zinc stearate, calcium stearate, etc.; 5) anti-static agents—carbon black, graphite, etc.; 6) lubricants—waxes, PTFE powder, polyethylene glycol, polypropylene glycol, polysiloxanes etc.

The backing material upon which the formulation is deposited can be a fabric, (woven, non-woven or fleeced), paper, plastic film or metal foil. Generally, the products made according to the present invention find their greatest utility in producing fine grinding materials and hence a very smooth surface is preferred. Thus finely calendered paper, plastic film or a fabric with a smooth surface coating is usually the preferred substrate for deposition of the composite formulations according to the invention.

The invention will be further described with respect to certain specific embodiments which are understood to be for the purposes of illustration only and imply no necessary limitation on the scope of the invention.

Abbreviations

To simplify data presentation, the following abbreviations will be used:

Polymer Components

Ebecryl 3605, 3700—acrylated epoxy oligomers available from UCB Radcure Chemical Corp.

TMPTA—trimethylol propane triacrylate available from Sartomer Company, Inc.

ICTA—isocyanurate triacrylate available from Sartomer Co., Inc.

TRPGDA—tripropylene glycol diacrylate available from Sartomer Co., Inc.

Binder Components

Darocure 1173—a photoinitiator available from Ciba-Geigy Company

Irgacure 651—a photoinitiator available from Ciba-Geigy Company

2-Methylimidazole—a catalyst from the BASF Corp.

Pluronic 25R2—polyoxypropylene-polyoxyethylene block copolymer available from the BASF Corp.

KBF₄—grinding aid with a median particle size of approximately 20 μ m available from Solvay.

Cab-O-Sil M5—fumed silica from Cabot Corporation

Grain

FRPL—fused Al₂O₃ from Treibacher (P320 or P1000: grade indicated by “P-number”).

Calcined Al₂O₃ (40 μ m) from Microabrasives Corporation.

6

Backings

3 mil Mylar film for ophthalmic applications

5 mil Mylar film for metalworking applications

Surlyn-coated J-weight polyester cloth * Surlyn is an ionomer resin SURLYN 1652-1 from Du Pont.

Abrasive Slurry Formulations

TABLE I

Component	I	II	III	IV
Ebecryl 3605	19.3%			
Ebecryl 3700		6.3%		
NVP	8.3%			
ICTA		7.9%	14.7%	14%
TMPTA		8.1%	14.7%	14%
TRPGDA		5.3%		
Irgacure 651		0.8%		
Darocure 1173	1.1%		0.6%	0.6%
2 MI	0.2%			
Cab-O-Sil		0.8%		
Silane	1.1%	0.8%		
Pluronic 25R2				1.4%
KBF ₄	23.3%	23.3%	23.3%	23.3%
Grain	46.7%	46.7%	46.7%	46.7%

Formulation Preparation Procedure

The monomers and/or oligomer components were mixed together for 5 minutes using a high shear mixer at 1000 rpm. This binder formulation was then mixed with any initiators, wetting agents, defoaming agents, dispersants etc. and mixing was continued for 5 minutes further at the same rate of stirring. Then the following components were added, slowly and in the indicated order, with five minutes stirring at 1500 rpm between additions: suspension agents, grinding aids, fillers and abrasive grain. After addition of the abrasive grain the speed of stirring was increased to 2,000 rpm and continued for 15 minutes. During this time the temperature was carefully monitored and the stirring rate was reduced to 1,000 rpm if the temperature reached 40.6° C.

Deposition of the Formulation

The resin formulation was coated on to a variety of conventional substrates listed previously. In the cited cases the abrasive slurry was applied using a knife coating with the gap set at desired values. Coating was done at room temperatures.

Application of Functional Powders and Embossing

Before embossing, the surface layer of the slurry was modified with abrasive grits with the same particle size or finer than that used in the formulation. Enough was deposited to form a single layer adhered by the uncured binder component. Excess powder was removed from the layer by vibration. Application of the powder was by a conventional, vibratory screening method.

Once the substrate had been coated with the uncured slurry formulation and the functional powder applied, an embossing tool with the desired pattern was used to impart the desired shape to the abrasive resin and grain formulation. This embossing setup included a steel backing roll which imparted the necessary support during the application of pressure by the steel embossing roll. A wire brush setup was used to remove any dry residue or loose grains remaining in the cells after the tool had imparted its impression on to the viscosity modified formulation.

249-220

Cure

After the pattern was embossed into the viscosity-modified layer, the substrate was removed from the embossing tooling and passed to a curing station. Where the cure is thermal, appropriate means are provided. Where the cure is activated by photoinitiators, a radiation source can be provided. If UV cure is employed, two 300 watt sources are used: a D bulb and an H bulb with the dosage controlled by the rate at which the patterned substrate passed under the sources. In the case of the matrix of experiments listed in Table 2, the cure was by UV light. In the case of the Formulation I, however, UV cure was immediately followed by a thermal cure. This curing process was adequate to ensure final dimensional stability.

In the first example, the layer was embossed by a roll having cells engraved therein in a 17 Hexagonal pattern. This produced the pattern of hexagonal shaped islands shown in FIGS. 1 and 2. In each, an abrasive grit was dusted on the surface to serve as the functional powder. In FIG. 1 the abrasive dusted on the surface was P1000 and in FIG. 2 it was P320. In each case the abrasive/binder formulation was Formulation I.

In the second example the embossing roll was engraved with a 25 Tri-helical roll surface pattern of grooves. FIGS. 3 and 4 show formulations III and IV as is used in the first experiment coated with P320 and P1000 abrasive grits respectively. The same coating technique was used.

In a third example the pattern engraved on the embossing roll was 45 Pyramid with formulation I giving a pattern of isolated square-based pyramids. The surface was modified by application of P1000 grit over the same formulation used in the first and second experiments. The result is shown in FIG. 5.

In all three experiments the structures on the embossed surface remained essentially unchanged from the time of the embossing to the time the binder component was fully cured.

Additional examples, similar in shape but varying in formulation and abrasive content were also carried out as listed in Table 2. In all cases, the manufacturing process is identical to the first three examples; however, variations were made in the resin composition and functional powders.

The 17 Hexagonal embossing roll pattern comprised cells 559 microns in depth with equal sides of 1000 microns at the top and 100 microns at the bottom.

The 25 Tri-helical pattern comprised of a continuous channel cut at 45 degrees to the roll axis that has a depth of 508 microns and top opening width of 750 microns.

The 40 Tri-helical pattern comprised of a continuous channel cut at 45 degrees to the roll axis that has a depth of 335 microns and a top opening width of 425 microns.

The 45 Pyramidal pattern comprised a square-based, inverted pyramid shaped cells with a depth of 221 microns and a side dimension of 425 microns.

Grinding Tests

Several of the listed samples were subjected to two primary forms of grinding testing with the data listed in Tables 3-5. The first form of testing consisted of Schieffler testing up to 600 revolutions with an 8 lbs. of constant load on a hollow, 304 stainless steel workpiece with a 1.1 inch O.D. which gives a effective grinding pressure of 23.2 psi. The patterned abrasive was cut into disks of 4.5" diameter and mounted to a steel backing plate. Both the backing plate and the workpiece rotate in a clockwise fashion with the backing plate rotating at 195 RPM and the workpiece rotating at 200 RPM. Workpiece weight loss was noted every 50 revolutions and totaled at the end of 600 revolutions.

The second method of testing consisted of a microabrasive ring testing. In this test, nodular cast iron rings (1.75 inch O.D., 1 inch I.D. and 1 inch width), were pre-roughened using a 60 μ m conventional film product and then ground at 60 psi. with the patterned abrasive. The abrasive was first sectioned into 1" width strips and was held against the workpiece by rubber shoes. The workpiece was rotated at 100 RPM and oscillated in the perpendicular direction at a rate of 125 oscillations/minute. All grinding was done in a lubricated bath of OH200 straight oil. Weight loss was recorded every 10 revolutions and totaled at the end of the test.

TABLE 2

Example	Embossed Pattern	Lines/Inch	Resin Formulation	Slurry		Functional Powder
				Thickness (mils)	Grain in Slurry	
1	Hexagonal	17	I	5	P320	P1000
2	Hexagonal	17	I	8	P320	P1000
3	Hexagonal	17	I	10	P320	P1000
4	Hexagonal	17	I	10	P320	P320
5	Tri-Helical	25	II	7	P320	P320
6	Tri-Helical	25	I	7	P320	P320
7	Tri-Helical	25	I	7	P320	P1000
8	Tri-Helical	25	III	7	P320	P320
9	Tri-Helical	25	III	7	P320	P320 + KBF ₄
10	Tri-Helical	25	III	7	40 μ m	40 μ m
11	Tri-Helical	25	IV	7	40 μ m	40 μ m
12	Tri-Helical	40	III	5	P320	P320 + KBF ₄
13	Tri-Helical	40	III	5	40 μ m	40 μ m
14	Tri-Helical	40	IV	5	40 μ m	40 μ m
15	Pyramidal	45	I	5	P320	P1200
16	Pyramidal	45	I	7	P320	P1200
17	Pyramidal	45	I	7	P320	P320
18	Pyramidal	45	I	10	P320	P1000

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIRECCIÓN DE NUEVAS CREACIONES

2020

Bogotá, D.C., 04 de febrero de 2011

✓ Abogado

EMILIO FERRERO

ASUNTO

Radicación 07 077023

Trámite 011

Evento 379

Actuación 519

Oficio

Folios

14 077023

Patente de Invención

☒

Vía PCT (fase nacional)

☒

Cap. I

☐

Cap. II

☒

No. Solicitud Internacional

PCT/US2006/002836

Fecha de Presentación Internacional 27/enero/2006

Como resultado del Examen de Fondo realizado, con fundamento en el Artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se comunica:

1. Documentos estudiados

Descripción: Folios 66 a 123 modificada en fase Internacional.

Reivindicaciones: Folios 171 a 194 modificadas en fase Internacional.

Dibujos: Folios 149 a 150 modificados en fase Internacional.

Oposiciones: No se presentaron.

Respuesta del solicitante:

Prioridad: US 60 648 168 de enero 28 de 2005

2. Análisis de la Prioridad

Se acepta la reivindicación de Prioridad porque:

Esta solicitud fue presentada dentro del plazo establecido (Art. 9 D 486).

Y su contenido técnico corresponde con el de la prioridad reivindicada.

3. Objeto de la invención

Título de la solicitud: "Artículos abrasivos y métodos para elaborar los mismos"

El problema planteado en esta solicitud es proveer productos abrasivos con buena relación de porcentaje de eliminación de material y terminado superficial, y métodos mejorados para elaborar dichos artículos.

Expediente 07 077023

Para resolver este problema técnico la solicitud en estudio proporciona una composición abrasiva mejorada reivindicación 1) y a partir de ésta diferentes artículos abrasivos (reivindicaciones 32, 44, 60, 102, 120 y 131) y métodos mejorados para la elaboración de éstos artículos (reivindicaciones 136, 145 y 151).

Clasificación Internacional de Patentes (CIP): B24D 003/028

4. De la Solicitud de Patente

Reivindicaciones (Art. 30 D 486, Art. 22 PCT)

Claridad:

- En varias reivindicaciones, por ejemplo las reivindicaciones 1, 4, 9, 10, 14, 15, 23, se utiliza el término "aproximadamente" que es impreciso; por lo cual no permite distinguir la invención del estado de la técnica. Se sugiere sustituirlo por un término preciso o un rango concreto.

- Las reivindicaciones 27-31, 78-83, 109-111 y 129-132 definen la invención en términos de resultados a alcanzar. No definen a la composición (ó productos), puesto que las reivindicaciones incluirían no sólo las soluciones propuestas por el solicitante, sino todas las alternativas presentes o futuras que lleguen a estos resultados. Se sugiere reemplazarlos por las características esenciales, estructurales o funcionales, que contribuyen a la obtención de dichos efectos.

- La reivindicación 47 es indefinida; no define a cuál tamaño de partícula se refiere (a los granos abrasivos o al llenador de partícula).

- Las reivindicaciones 49 y 114 son indefinidas; no queda claro a que tamaño de partícula promedio se refirieren.

- La reivindicación 53 es indefinida; porque habla de un "precursor acrílico" y en su reivindicación independiente 44 no se define dicho material.

Las reivindicaciones 1 – 158 no son concisas, pues el excesivo número de reivindicaciones independientes hacen que sea difícil determinar la materia para la que se solicita la protección.

Se requiere al Solicitante hacer las aclaraciones necesarias.

5. Determinación del Estado de la Técnica

El Estado de la Técnica se determinó con base en la:

Fecha de Presentación de la Solicitud de Prioridad: enero 28 de 2005

Y se encontraron los siguientes documentos que anticipan el objeto de esta solicitud:

Item	Documento	Título	Fecha de Publicación*
D1	US4457766	Resin systems for high energy electron curable resin coated webs	03/julio/1984
D2	US5833724	Structured abrasives with adhered functional powders	10/noviembre/1998

D1 divulga (columna 1, renglones 7 - 12) materiales y métodos para la formación de materiales de recubrimiento abrasivos y el curado de los recubrimientos sobre tela o papel.

D2 divulga (columna 1, renglones 8 - 10) un método para producir una estructura abrasiva sobre sustratos para ser usados en el acabado fino de diferentes sustratos.

6. Análisis de Patentabilidad (Art 14 D486)

Novedad (Art 16 D486)

La reivindicación 1 se refiere a una composición que comprende granos abrasivos y una composición ligadora, dicha composición ligadora comprende un compuesto catiónicamente polimerizable, un compuesto radicalmente polimerizable y un llenador de partículas (submicrónicas dispersadas).

Comparación de las características técnicas **esenciales**, con las del estado de la técnica:

Características esenciales	D2
Composición	
a) Granos Abrasivos	
b) Composición Ligadora (C.L.)	
- compuesto catiónicamente polimerizable (10-90 % en peso de C.L.)	SI
- compuesto radicalmente polimerizable (<40 % en peso de C.L.)	
- llenador de partículas (5-80 % en peso de C.L.)	

Las características técnicas **esenciales** de la reivindicación 1 se ven anticipadas en el documento del estado de la técnica, (D2: columna 6/tabla 1), en el cuál se revela una composición que comprende granos abrasivos, un compuesto catiónicamente polimerizable (resina epóxica), un compuesto radicalmente polimerizable (un triacrilato) y un llenador de partículas (humo de sílice). Puesto que no se tiene claridad sobre el porcentaje de los granos abrasivos con respecto a la composición ligadora, las cantidades de los ingredientes descritos en la tabla 1 caen dentro de los rangos presentados en la reivindicación 1, por lo tanto dicha reivindicación no se considera nueva.

Novedad (Art 16 D486)

La reivindicación 32 se refiere a un artículo abrasivo que comprende granos abrasivos y una composición ligadora, la formulación de la composición ligadora comprende un precursor epoxi nanocompuesto y un precursor acrílico.

Comparación de las características técnicas **esenciales**, con las del estado de la técnica:

Características esenciales	D2
Artículo abrasivo	
a) Granos Abrasivos	
b) Composición Ligadora (C.L.)	
- precursor epoxi (<40 % en peso de C.L.)	SI
- precursor acrílico	

Las características técnicas **esenciales** de la reivindicación 32 se ven anticipadas en el documento del estado de la técnica, (D2: columna 6/tabla 1), en el cuál se revela una composición que comprende granos abrasivos, un precursor acrílico (triacrilato) y un precursor epoxi (polioxipropileno-polioxietileno). Puesto que no se tiene claridad

sobre el porcentaje de los granos abrasivos con respecto a la composición ligadora, las cantidades de los ingredientes descritos en la tabla 1 caen dentro de los rangos presentados en la reivindicación 32, por lo tanto dicha reivindicación no se considera nueva.

Novedad (Art 16 D486)

La reivindicación 44 se refiere a un artículo abrasivo que comprende granos abrasivos y una composición ligadora, la formulación de la composición ligadora comprende un precursor epoxi y un llenador de partícula.

Comparación de las características técnicas **esenciales**, con las del estado de la técnica:

Características esenciales	D2
Artículo abrasivo	
a) Granos Abrasivos	
b) Composición Ligadora (C.L.)	SI
- precursor epoxi (>5 % en peso de C.L.)	
- llenador de partícula	

Las características técnicas **esenciales** de la reivindicación 44 se ven anticipadas en el documento del estado de la técnica, (D2: columna 6/tabla 1), en el cuál se revela una composición que comprende granos abrasivos, un precursor epoxi (polioxipropileno-polioxietileno) y un llenador de partícula (humo de sílice). Puesto que no se tiene claridad sobre el porcentaje de los granos abrasivos con respecto a la composición ligadora, las cantidades de los ingredientes descritos en la tabla 1 caen dentro de los rangos presentados en la reivindicación 44, por lo tanto dicha reivindicación no se considera nueva.

Novedad (Art 16 D486)

Las reivindicaciones 60 y 102 se refiere a un artículo abrasivo que comprende granos abrasivos y un ligador.

Comparación de las características técnicas **esenciales**, con las del estado de la técnica:

Características esenciales	D2
Artículo abrasivo	
a) Granos Abrasivos	SI
b) Ligador	

Las características técnicas **esenciales** de las reivindicaciones 60 y 102 se ven anticipadas en el documento del estado de la técnica, (D2: columna 6/tabla 1), en el cuál se revela una composición que comprende granos abrasivos y un ligador (resina). Puesto que no se tiene claridad sobre el porcentaje de los granos abrasivos con respecto al ligador, las cantidades de los ingredientes descritos en la tabla 1 caen dentro de los rangos presentados en la reivindicaciones 60 y 102, por lo tanto dichas reivindicaciones no se consideran nuevas.

Novedad (Art 16 D486)

La reivindicación 120 se refiere a un artículo abrasivo que comprende granos abrasivos y una composición ligadora, la formulación de la composición ligadora comprende un llenador de partícula.

Comparación de las características técnicas **esenciales**, con las del estado de la técnica:

Características esenciales	D2
Artículo abrasivo	
a) Granos Abrasivos	SI
b) Composición Ligadora (C.L.)	
- llenador de partícula	

Las características técnicas **esenciales** de la reivindicación 120 se ven anticipadas en el documento del estado de la técnica, (D2: columna 6/tabla 1), en el cuál se revela una composición que comprende granos abrasivos y un llenador de partícula (humo de sílice). Puesto que no se tiene claridad sobre el porcentaje de los granos abrasivos con respecto a la composición ligadora, las cantidades de los ingredientes descritos en la tabla 1 caen dentro de los rangos presentados en la reivindicación 120, por lo tanto dicha reivindicación no se considera nueva.

Novedad (Art 16 D486)

La reivindicación 131 se refiere a un artículo abrasivo que comprende granos abrasivos y un ligador (copolímero epoxi/acrilato).

Comparación de las características técnicas **esenciales**, con las del estado de la técnica:

Características esenciales	D2
Artículo abrasivo	
a) Granos Abrasivos	SI
b) Composición Ligadora (C.L.)	
- copolímero epoxi/acrilato	

Las características técnicas **esenciales** de la reivindicación 44 se ven anticipadas en el documento del estado de la técnica, (D2: columna 6/tabla 1), en el cuál se revela una composición que comprende granos abrasivos y un copolímero epoxi/acrilato (resina). Puesto que no se tiene claridad sobre el porcentaje de los granos abrasivos con respecto a la composición ligadora, las cantidades de los ingredientes descritos en la tabla 1 caen dentro de los rangos presentados en la reivindicación 131, por lo tanto dicha reivindicación no se considera nueva.

Novedad (Art 16 D486)

Las reivindicaciones 136, 145 y 151 se refieren a métodos para formar un artículo abrasivo y generalmente comprenden suministrar un ligador (sea formado o para formar *in situ*) o una composición ligadora y unos granos abrasivos, junto con el ligador o después de que éste recubra un sustrato y luego curar el ligador.

Comparación de las características técnicas **esenciales**, con las del estado de la técnica:

Características esenciales	D1	D2
Método para formar un artículo abrasivo		
a) Suministrar un ligador o composición ligadora	SI	SI
b) Suministrar un ligador		
c) Curar ligador		

Las características técnicas **esenciales** de las reivindicaciones 136, 145 y 151 se ven anticipadas en los documentos del estado de la técnica, (D1: columna 5/renglón

40 – columna 7/renglón 47, D1: columna 6/renglón 28 – columna 7/renglón 15), en los cuáles se revelan métodos para la formación de artículos abrasivos sobre sustratos como los presentados en las reivindicaciones 136, 145 y 151, por lo tanto dichas reivindicaciones no se consideran nuevas.

7. Conclusión

Los requisitos de Patentabilidad de la presente solicitud están afectados así:

Item	Documento	Reivindicaciones afectadas	Requisito que afecta
D1	US4457766	1 – 158	Novedad
D2	US5833724	136 – 158	Novedad

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de 60 días contados a partir de la fecha de notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única N° 10 de 2001.



JOSÉ LUIS SALAZAR LÓPEZ
Director de Nuevas Creaciones (C)

El anterior requerimiento fue notificado por fijación en lista, de fecha
10 MAR. 2011

CONCEPTO TÉCNICO No. 429	EXAMINADOR TÉCNICO Código No. 2020101
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