

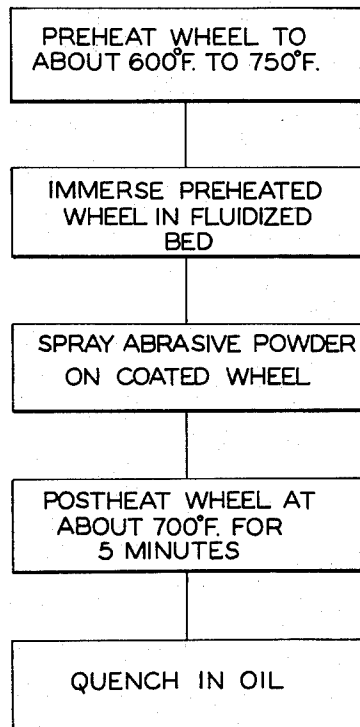
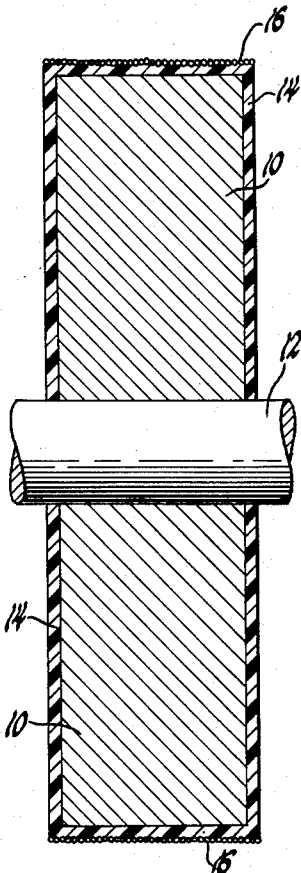
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ABRASIVE TOOL

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ABRASIVE TOOL

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This invention relates to abrasive articles such as grinding or polishing wheels, and more particularly to a method of manufacturing the same.

The manufacture of grinding wheels as is generally practiced involves the bonding together of a mass of abrasive particles by means of suitable adhesives. The process generally used involves first coating a loose mass of abrasive grains or particles of suitable materials such as carbide powder, aluminum oxide powder and the like with a synthetic resin type binding material, usually a heat-curable phenol-formaldehyde resin dissolved or otherwise contained in a liquid vehicle, permitting the vehicle of the binding agent to evaporate and then subjecting a mass of the binder coated abrasive particles to heat and pressure whereby the binder is cured to form a hard, infusible mass and the abrasive particles are bonded together to form a more or less porous structure. The porous structure is then usually treated by incorporating substances in the pores thereof which prevent the surface pores of the wheel from being packed or loaded with metal particles during the grinding operations and thereby reducing the efficiency and life of the wheel. Among the treatments which have been suggested for this purpose is that of impregnating the wheel with impregnants such as curable liquid rubber drawn into the porous structure by a vacuum technique with or without additives such as iron sulfide or potassium fluoborate which are believed to further enhance the prevention of loading. The liquid rubber within the pores is subsequently cured. Grinding or polishing wheels are also commonly impregnated with various waxes for the purpose of preventing loading of the wheel.

Among the basic objects of this invention is to provide a novel grinding wheel which is equivalent or superior to grinding wheels of the prior art and a method for its manufacture which is more efficient and economical than those of the prior art.

In general, these and other objects are accomplished by first providing a metal wheel core of the general shape of the grinding or polishing wheel which it is desired to manufacture. The metal wheel is then coated with a suitable melted thermoplastic resin. This is preferably accomplished by first heating the metal wheel to a temperature in excess of the melting temperature of the resin, then dipping the wheel into a fluidized bed of the resin powders while rotating it for a time sufficient to cause a fusion of the resin material of a suitable thickness on the metal wheel, then removing the wheel with the molten coating upon it from the fluidized bed and spraying preferably an abrasive powder over the molten resin while the coating is still in a molten condition and permitting the resin to solidify.

In the preferred embodiment of the invention the resin employed is a polyamide such as polyhexamethylene adipamide. In applying the resin, the metal wheel is heated to about 600° F. to 750° F., a temperature sufficient to melt the polyamide and effect the fusion of a suitable layer thereon. The abrasive sprayed onto the molten polyamide is a diamond powder. After the abrasive powder has been sprayed onto the molten polyamide, the wheel is preferably again heated to a temperature of about 700° F. to effect a more thorough fusion of the resin and locking in, so to speak, of the abrasive powder. The

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combination of the polyamide resin and diamond powders involved in the preferred embodiment of the invention gives the polishing wheel a friability which provides a superior polishing action.

Other objects and advantages will be apparent from the following detailed description of the invention, reference being had to the drawings, in which:

FIGURE 1 is a grinding wheel in accordance with the invention; and

FIGURE 2 is a flow diagram of the process employed to make the preferred wheel of this invention.

The process of this invention makes use of a resin coating process well known in the art in which a fluidized bed is provided of suitable synthetic resin coating powders. This process is fully disclosed in the United States Patent No. 2,844,489 Gemmer. As described in this patent, a powdered mass of meltable synthetic resin powder is transformed into a fluidized bed by introducing a current of gas under pressure at the gas permeable base thereof, the bed being maintained in a fluidized state by controlling the flow rate of the gas through the bed of resin powder. The article to be coated is immersed into the fluidized bed of the powdered resin after being heated to a temperature sufficient to melt the resin. The individual particles of the coating resin adhere, melt and fuse together upon the hot surface of the immersed portion of the article to form a continuous coating thereon of a desired thickness depending on the length of immersion.

In accordance with the present invention a fluidized bed of a polyamide resin (nylon) in a finely divided state is provided. Polyamide resins which have been found equally useful in the practice of the preferred embodiment of the invention include the aforementioned polyhexamethylene adipamide (known commercially as nylon 66), epsilon polycaprolactam (known commercially as nylon 6) and polyhexamethylene sebacamide (known commercially as nylon 610).

A metal wheel or core 10 preferably in the form of an iron casting adapted to be mounted on a suitable shaft 12 is employed as a base for supporting an abrasive surface to be formed in accordance with the process of this invention. The core 10 is first heated to a temperature of about 700° F. in a suitable furnace, then withdrawn from the furnace and immediately immersed in a fluidized bed of polyhexamethylene adipamide powder (nylon 66) for a period of about 5 seconds. Core temperatures of from about 600° F. to 750° F. are satisfactory. While the heated core is immersed in the fluidized bed, the nylon powders coming in contact therewith melt and fuse together upon the hot surface to form a continuous coating 14 about the entire wheel of about 7 mils in thickness. The core 10 is preferably dipped into the fluidized nylon bed, held therein and withdrawn while rotating it to insure that a smooth uniform coating of the nylon is fused thereon.

Next, a layer of diamond power 16 formed of powders of a size equal to the size of the openings in a screen ranging from about a 40 to a 320 mesh screen is sprinkled onto the nylon coating while the latter is still in a plastic or soft condition. The abrasive powder may be applied by other suitable techniques such as rolling the coated wheel in a mass of the abrasive material. Next, the wheel having the nylon coating and sprayed diamond particles thereon is inserted into the furnace maintained between about 600° F. and 750° F. for a period of at least about 30 seconds to about 5 minutes depending on the size of the wheel and the thickness of the nylon coating, to effect a more thorough fusion of the nylon particles. Finally, the article is quenched in oil to complete the process.

Useful grinding or polishing wheels may be made employing other abrasive materials such as aluminum oxide

powder or carbide powders. Similarly, useful grinding or polishing wheels may be made employing other coating materials in powdered form such as epoxy resin powders, cellulosic and polyethylene powder. The optimum temperature employed both in the latter post cure step and the coating application step will, of course, vary depending on the coating resin used. In some instances the post cure step may be unnecessary.

It has been found that satisfactory polishing wheels may be formed with the nylon layer 14 ranging in thickness from about 5 to 15 mils, 7 mils being preferred as previously indicated. In the preferred embodiment of the invention employing a nylon coating and a diamond abrasive powder, a friability is obtained and improved polishing action is obtained at a lower cost per unit tool in contrast to the grinding or polishing tools of the prior art. An important advantage in the process is that the abrasive grit appears in the grinding wheel in precisely the size in which it is applied. In contrast to this, similar wheels in the prior art which involve pounding the diamond powder mechanically into the wheel, the size of the diamond powder is reduced during the pounding process.

While the embodiment of this invention as disclosed herein constitutes a preferred form, it is to be understood that other forms may be adopted without departing from the spirit of the invention.

We claim:

1. The method of making a polishing wheel or the like comprising the steps of providing a metal core having a circular peripheral surface adapted to form the abrading surface of a tool, preheating said core to a temperature in the range of about 600° F. to 750° F., immersing said preheated core in a gas fluidized bed of a powdered polyamide resin for a period of time sufficient to form a polyamide layer of a thickness ranging from about 5 mils to 15 mils thereon, applying diamond powders onto said surface while said coating is yet in a plastic condition and again heating said wheel at a temperature of between

about 600° F. and 750° F. for at least about 30 seconds to effect a thorough fusion of said polyamide resin.

2. The method of making polishing wheels or the like which comprise a metal core having a peripheral surface coated by a continuous layer of a synthetic resin, the steps comprising providing a metal core substantially of the shape of the desired polishing wheel having peripheral polishing surfaces, preheating said core to at least the melting temperature of said resin, immersing said core in a gas fluidized bed of said resin in powdered form for a time sufficient to cause the resin particles in contact with said core to melt and fuse to form a uniform continuous smooth coating thereon, removing said core from the fluidized bed and while the coating is still in a soft condition applying a layer of abrasive powder to said binder surface.

3. The method of making a polishing wheel or the like comprising the steps of providing a metal core having a peripheral surface adapted to form the abrading surface of a tool, preheating said core to a temperature in the range of about 600° F. to 750° F., immersing said preheated core while rotating it in a gas fluidized bed of a powdered polyamide resin for a time sufficient to cause polyamide particles coming into contact with the core surface to melt and form a layer of uniform thickness ranging from about 5 mils to 15 mils thereon, applying a layer of about 40 to 320 mesh diamond powders onto said surface while said coating is yet in a plastic condition and again heating said wheel to a temperature of between about 600° F. and 750° F. for at least about 30 seconds.

References Cited in the file of this patent

UNITED STATES PATENTS

2,793,478	Rohowetz	May 28, 1957
2,862,806	Nestor	Dec. 2, 1958
2,913,858	Fraeg et al.	Nov. 25, 1959
2,920,947	Burk et al.	Jan. 12, 1960