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TRANSPARENTIZING BASE STOCK OF TRACING PAPERS AND INTERMEDIATE DIAZOTYPE PAPERS BY USE OF POLYPROPENES

Joseph F. Kosalek, Binghamton, N.Y., assignor to General Aniline & Film Corporation, New York, N.Y., a corporation of Delaware

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The present invention relates to the transparentizing of paper base stock used in tracing papers, in intermediate diazotype papers, or certain photographic papers by impregnation of the paper with a resin derived from a polymer of a low molecular weight olefine.

Raw tracing grade papers generally are treated to achieve greater transparency to ultraviolet light sources and to improve see-through for overlay tracing purposes. The basic weights of such papers vary to meet customer demands. The increased transparency as a result of the transparentizing treatment leads to faster reprint speeds in the reproduction of engineering drawings and other subject matter in numerous photocopying machines currently available on the market. The transparentization of such paper base stock is, therefore, an important item in the photocopying field.

Transparentizing of paper base stock for subsequent sensitization with diazo formulations is also of utmost importance. By transparentizing these paper bases, faster reprint speeds are achieved in "whiteprint" machines used for exposing and developing diazotype materials. Transparentized diazo intermediate papers are generally used in making subsequent reproductions on other light-sensitive materials such as standard diazotype papers, cloths, films and the like in whiteprint machines.

The types and grades of raw paper used for tracing paper products and diazo sensitized intermediates vary considerably but all of them can be transparentized to considerable advantage. These papers may consist of 25%, 50% or 75% rag paper, the balance being made up by means of wood pulp, i.e., sulfite, or vegetable pulp such as bamboo, or the paper may consist of 100% rag or 100% sulfite paper. The basic weight of such papers may vary but most commonly 500 sheets of 17" x 22" will weigh from 12 to 20 pounds.

It has been proposed in the past to transparentize base stock for tracing papers and diazo intermediate papers by impregnating the papers with a resin such as polystyrene, polymethylated styrenes and chlorinated aromatic hydrocarbons, i.e., chlorinated diphenyl. While some improvement is realized by such materials, the results are far from optimum. Thus with the tracing papers there is noted that the transparentized prior art papers have a tendency to "ghost" which is a function of folding and fracture of the resin and paper films. Ghost lines resulting from such fracture will block ultraviolet light causing undesirable lines to be formed in making copies on other reproduction papers. Furthermore, both the tracing papers and intermediate papers transparentized as aforesaid have a distinct tendency to yellow under the influence of ultraviolet light. There is, therefore, a crying need in the art to provide a transparentizing medium which will be free from the defects noted in the prior art transparentized papers.

I have now discovered that by using as the transparentizing medium polypropene alone or mixtures thereof, with other water white resins such as polyethylene, polystyrene, or polymethyl methacrylate, the paper base stock for tracing papers and intermediate diazo papers are very markedly improved as compared to transparentized papers presently on the market. Thus papers transparentized with polypropene resins or mixtures with about 10 to 50% by

weight of other water clear, colorless resins as indicated above lead to a considerable decrease in ghosting of the tracing papers. In addition, paper base stock transparentized as contemplated herein has excellent permanency to heat and is essentially non-yellowing when exposed to ultraviolet light sources. Further, since the polypropene resin does not form a hard film, it aids in plasticizing the paper, making it soft and pliable.

Finally an item which is of importance to the manufacture of the transparentized paper is the low cost of the polypropene resin.

Polypropene is available on the open market in various grades. Its specific gravity usually varies from about 0.89 to 0.91. The polymers which I prefer to use have a median molecular weight ranging from 600 to 1500. Examples of polypropenes which I have found to be particularly useful are those available from Amoco Chemical Corporation as Amopol C–60, C–100 and C–175. These liquids have a viscosity ranging from 50 to 200 centistokes when measured at 99° C. Their refractive index is between 1.4730 and 1.4770. The C–60 grade is of particular interest since it has the lowest molecular weight and can be used at higher concentrations and lower viscosity effects. Lower viscosity solutions are highly desirable for rapid penetration of the paper and greater ease in achieving transparency. In any case the polypropene resins as a class are particularly useful because they are essentially water white, odorless, stable to light, provide a high degree of permanency, and retain their physical characteristics at prolonged exposures to heat or heat plus the ultraviolet light source.

Transparentizing the paper base stock may be effected in various ways. For example, the paper base stock may be impregnated by immersing the stock in a solution of polypropene to assure complete impregnation, winding the wet paper in a roll, and allowing the wet packed roll to stand for a period of from 4 days to 1 week. The paper is then heated to dry it by solvent removal.

Alternatively the paper may be impregnated by applying the polypropene solution to one side of the paper prior to diazo sensitizing and almost immediately drying to remove the solvent. In such a process the transparentized paper need not be rewound or be wet-packed in roll form as recommended in the above described modification of the process. In this modification of the process the paper is then given a backwet on the wire side and is subsequently diazo sensitized. In still another modification, the raw paper is first backwetted on the wire side and then diazo sensitized on the felt side. A solution containing polypropene resin, or mixtures thereof with the previously mentioned water clear resins, is then applied to the wire side of the diazo sensitized paper. The treated paper is then dried at elevated temperatures to obtain a transparentized material which is useful for the production of diazotype intermediate prints. The above described modifications of my process lend themselves to the use of various types of equipment to obtain an end product with the desired degree of transparency.

Manifestly if the paper is to be used for making tracing paper it is not backwetted or sensitized. On the contrary, for tracing paper it is converted to sheets or rolls according to customer demand.

If desired, a suitable dye or dyes may be added to the transparentizing solution for the purpose of tinting the transparentized paper base. These dyes are of the oil soluble variety and must be soluble in, and compatible with, the solvents used for dissolving the polypropene. Among the dyes which we have found suitable are Alizarine Irisol N Powder Oil Soluble Dye and Heliogen Blue Oil Soluble Dye, both of which are commercially available and sold by General Dyestuff Corporation.

The following examples illustrate the invention although it is to be understood that the invention is not restricted thereto:

Example I

30 parts by volume of polypropene "Amopol C–60" were dissolved in 70 parts by volume of solvent naphtha. 100% rag paper was immersed in the solution until the paper had become completely impregnated. The wet paper was then wound in a roll and allowed to stand for a period of one week. The paper was then dried by heating above the boiling point of the solvent naphtha. The paper can then be used for diazo sensitizing or directly as a tracing paper.

A backwetting formula was applied with the following solution to the wire side of the paper and dried:

Water	ml.	100
Ethylene glycol	ml.	4
Saponin	gr.	0.15

The backwetted paper was then sensitized on the felt side with the following sepia sensitizing formulation and dried:

Water	ml.	100
Citric acid	gr.	7
Thiourea	gr.	5
Resorcinol	gr.	2
4 - (N - methyl-N-hydroxyethyl)-aminobenzenediazonium chlorozincate	gr.	4
Saponin	gr.	0.15

After conversion, the paper was ready for use as intermediate paper in which it is exposed under the ultraviolet light source with a pattern in a whiteprint machine and developed by emerging over an ammonia chamber in the machine to form a print of the pattern. The transparentized prints can then be used as a diazo original for making subsequent reproductions on more opaque standard diazo sensitized paper at a rapid speed. Transparentization according to this example permits 30 to 60% faster reprint speed than would be obtained by a raw non-transparentized paper.

Example II

30 parts by volume of polypropene were dissolved in 70 parts by volume of toluene. 100% sulfite paper was immersed in this solution to insure thorough impregnation of the paper. The paper was then wound in a roll and allowed to stand for a period of 7 days. The paper was then dried to remove the toluene. The paper can be used directly as a tracing paper or can be sensitized as a diazo intermediate.

Example III

25% rag paper, the balance being sulfite paper, was immersed in the following solution:

	Ml.
Xylene	70
Polypropene C–60 grade	30

until the paper was thoroughly impregnated with the solution. The paper was then allowed to stand for a period of one week after which the paper was dried by heating above the boiling point of the solvent. A backwetting formula as in Example I was then applied to the wire side of the paper and dried. The backwetted paper was then sensitized on the felt side with the following sensitizing formula and dried:

Water	ml.	100
Citric acid	gr.	4
Boric acid	gr.	2
Thiourea	gr.	5
2,2'-4,4'-tetrahydroxydiphenyl	gr.	2
p-Diazo-diethyl aniline-zinc chloride double salt	gr.	3

The paper thus sensitized may be used in the same fashion as the paper in Example I.

Example IV

A transparentized paper prepared as described in Example I was coated with a high contrast gelatin silver halide emulsion. After exposure through a negative, conventional processing by developing in a black and white developer solution containing a silver halide developing agent, short stopping, fixing, washing and drying, a positive print of excellent pictorial quality and high transparency useable for projection or reproduction purposes was obtained.

The following examples show the blending of polypropene with other resins in order to obtain suitably transparentized paper.

Example V

Toluene	ml.	70
Polypropene C–60	ml.	15
Polystyrene PS–2	gr.	15

A paper impregnated with this solution gave prints of excellent transparency when coated with a diazotype sensitizing solution as described in Example I. Polystyrene PS–2 is a commercially available solid polystyrene resin manufactured by the Dow Chemical Company.

Example VI

	Ml.
Toluene	70
Polypropene C–60	15
Dow V–2 resin	15

A paper impregnated with this solution and coated with a diazotype sensitizing solution as described in Example I gave prints of excellent transparency. Dow V–2 resin is a commercially available resin sold by the Dow Chemical Company and is derived from α-methylstyrene.

It is to be understood that the critical feature of the present invention resides in the use of polypropene to transparentize paper base stock to be used for tracing papers or in the formation of transparentized diazo intermediate paper. The polypropene may be used with a small quantity, say 5 to 10% of a compatible water white resin such as polystyrene if desired.

When the paper is to be used in the formation of intermediate diazo papers any of the usual diazos may be employed. For example, I may employ diazo derived from N,N-diethyl-2-ethoxy-p-phenylenediamine; N - ethyl - 2-methyl-p-phenylenediamine; N,N-bis(β-hydroxyethyl)-p-phenylenediamine; the diazo compounds disclosed in U.S. Patent 2,298,444 which may be substituted in the 2 and 5 position of the benzene ring by ethoxy, propoxy, butoxy or the like.

What has been said about the diazos applies equally to the couplers. Thus in addition to the couplers of the examples, we may use 2,5-xylenol; 2,3-dihydroxynaphthalene; 1,8-dihydroxynaphthalene; resorcinol; octyl resorcinol; p-methyl-N-phenyl pyrazolone; α-resorcylic acid; the amide of α-resorcylic acid; 2-hydroxynaphthalene-3,6-disulfonic acid; H acid; acetyl acetanilide or 2,3-dihydroxynaphthalene-6-sulfonic acid. In short, the sensitizing formulation and the backwetting formulation are conventional.

The quantity of polymer to solvent will vary depending upon the weight of the paper and the degree of transparency desired. These are features which can readily be ascertained by any skilled operator in this field.

Modifications of the invention will occur to persons skilled in the art. For instance, the transparentized paper base is also suitable for use in the silver salt diffusion transfer process, after being coated with a colloid layer such as a gelatin or polyvinyl alcohol layer which contains reductiton nuclei such as colloidally dispersed silver, silver sulfide and the like. Therefore, I do not intend to be limited in the patent granted except as necessitated by the appended claims.

I claim:

1. A process for the production of light-sensitive diazo material having a transparentized paper base which comprises impregnating paper base stock with a solution of a resin consisting essentially of polypropene in an organic solvent selected from the class consisting of solvent naphtha, xylene and toluene, winding the paper while wet with said solution in a roll, allowing it to stand for a period of at least four days, drying, wetting one surface with an aqueous solution to prevent curl, and applying to the opposite surface an aqueous light-sensitive diazo compound solution.

2. A process as defined in claim 1 wherein said resin consists of about equal parts by weight of polypropene and of a polystyrene resin.

3. Light-sensitive diazo material having as a base, paper transparentized by impregnating with a resin consisting essentially of polypropene deposited from a solution thereof in a solvent selected from a class consisting of solvent naphtha, xylene and toluene and a light-sensitive diazo compound coated on one surface of said base.

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NORMAN G. TORCHIN, *Primary Examiner.*

ALEXANDER D. RICCI, *Examiner.*

C. L. BOWERS, R. L. STONE, *Assistant Examiners.*