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FOILS FOR COATING PURPOSES

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The present invention relates to a compound foil suited as coating material.

The problem to provide various kinds of supports, such as tissue, paper or wood, with a coating by applying thereon a foil made of a suitable plastic material, exists already for a long time. However, foils which have to be useful as coating material must meet various requirements. First of all, the foil must possess a mechanical and chemical resistance and, if possible, it must to a large extent be resistant to heat. Furthermore, it is necessary that the foil can be applied with simple means smoothly and free from pores to all the various kinds of supports and that it can be tightly combined with said supports. The adhesion must be so good that support and foil cannot be separated by the action of water, oils, fats or the like. Moreover, it is desirable that the coating foil can rapidly be fixed to the support so as to enable a continuous operation. Furthermore, the coated material must not have any tendency to roll. The hitherto used coating foils or coating processes did, however, not satisfactorily fulfill these various requirements. The covering of tissue, paper, wood and the like with foils of plastic materials has, therefore, not yet attained any particular industrial importance.

The present invention relates to a foil which is particularly suitable as a coating material. This new material is a compound foil consisting of two layers of various super-polyamides. By the term super-polyamides there are to be understood, as is known, linear condensation products of a high degree of polymerization which are characterized by the —NHCO-groups contained in the molecule and are produced for instance from ω-ω'-diamines and ω-ω'-dicarboxylic acids or from amino-carboxylic acids or the lactames thereof. In such super-polyamides the melting point and the behaviour towards solvents and swelling agents may be influenced to a large degree by the selection of the starting materials used for their manufacture. It is possible to prepare super-polyamides which, if a suitable swelling agent is used, may be softened readily i. e. at a relatively low temperature, whereas, on the other hand, super-polyamides may be obtained which by means of the swelling agent applied may be softened with difficulty, i. e. only at a very high temperature or which are substantially stable to swelling agents. According to the present invention a compound foil is prepared from two layers of superpolyamides; one of the layers can be softened by means of a swelling agent under conditions at which the other layer still remains resistant with regard to its form.

A compound foil as herein described may be obtained by first preparing separately as independent foils the two layers of which the compound material is composed, and then combining the layers by means of a solvent, for instance ethylene chlorohydrine. If one of the superpolyamides or even both super-polyamides are readily soluble in a usual solvent, it may be advisable to pour one layer on to the other. The thickness of the compound foil may be kept very low; it may amount to less than 0,04 mm. If a high flexibility of the foil is desired, the compound foil must be made as thin as possible. The thickness of the difficultly softenening layer may be limited to 0,01 mm and, if required, to even less than 0,01 mm; any damage of said layer when the material is worked up has not to be feared. The readily softening layer is suitably somewhat thicker. In order to distinguish the difficultly softening side from the readily softening side of the compound foil, when using it in working, one of the two layers, suitably the readily softening layer, may be marked. Preferably a mat surface is given to the readily softening layer. This mat effect disappears during the coating process.

The coating process of the new compound foil occurs as follows: the readily softening layer of the compound foil and the support to be coated are superposed after having moistened the support or the layer named with an agent capable of allowing said layer to swell. The foil is then ironed on to the support by a hot process or it is compressed thereon by means of hot rollers. During this operation an intimate connection between support and readily softening layer of the compound foil immediately takes place, but the outside layer of the foil is not damaged or altered in any way. On suitably selecting the two layers of the compound foils there is no risk that the top layer of the coating material be impaired, even not in those cases where the operating temperature during the coating process is increased far beyond the necessary degree or the heating operation lasts essentially longer than it is necessary. By the coating process with the new compound foil good results are, therefore, attained even in those cases where the operating conditions prescribed are not exactly observed. In practice, this fact is very advantageous and operating is considerably simplified thereby.

The difficultly softening layer of the new compound foil may, for instance, be prepared from a

super-polyamide which has been obtained from the salt of hexamethylenediamine with adipic acid. This product has a relatively high melting point and cannot be softened by the usual solvents. It is also possible to use difficultly softening superpolyamides prepared from aminocaproic acid or caproic lactam. Foils of these super-polyamides are prepared by may of fusion. The foils may, if required, be stretched in one direction or in all directions. The readily softening layer used as adhesive substance in the coating process is advantageously made of mixed superpolyamides as they are, for instance obtained by condensing together at least two starting materials capable of forming super-polyamides, at least one of the starting substances, but suitably not all of the starting materials being amino-carboxylic acids or functional derivatives of aminocarboxylic acids. For this purpose there are for instance suitable the super-polyamides for the preparation of which a mixture of hexamethylene-diamine and adipic acid or a salt of these compounds on the one hand and ε-amino-caproic acid or the lactam thereof on the other hand have been used. Instead of adipic acid there may, for instance, have been used a functional derivative of said acid, for instance an ester, an amide or the anhydride. Instead of adipic acid another suitable dicarboxylic acid and instead of hexamethylene-diamine another suitable diamine may have been used. Such super-polyamides are preferably used for the preparation of which there have been applied from the diamino-salts of the dicarboxylic acids or the corresponding mixtures of free diamines and dicarboxylic acids about from a half up to twice the amount of the aminocarboxylic acid. The mixed super-polyamides thus obtained may, in general be softened with application of heat by means of aqueous aliphatic alcohols, i. e. readily accessible solvents which can be handled without any danger. Some of the mixed super-polyamides may even be softened, while heating, already with water alone. In the softened condition the mixed superpolyamides have a very strong adhesive power. They may be extremely tightly combined with supports consisting of tissue, paper, wood, or the like. Particularly good results may, for instance, be attained by using as adhesive layer of the compound foil a mixed superpolyamide which has been prepared from amino caproic acid and the salt of hexamethylene diamine with adipic acid, the amino caproic acid amounting to 35–70% of the condensation mixture. If the said compounds are employed in the proportion of 2:3 the coating process may be performed with the aid of aqueous ethyl alcohol of 20 per cent strength or an aqueous glycerin solution of 10 per cent strength. In spite of this behaviour the resistance of the mixed super-polyamide herein described to water is even so high that a separation between support and foil by treating the covered material with boiling water, cannot occur; the adhesion of the combined support and foil is likewise not impaired by the action of hydrocarbons, oils or fats.

The new compound foil is distinguished by a high mechanical and chemical resistance. It may be very rapidly and solidly combined with various kinds of supports, while applying simple adjuvants; a careful observation of exact operating conditions is not necessary. Inflammable solvents need not be used. With other respects the material likewise fulfils, as regards its properties, the conditions named above which in practice are required by a good coating material. It must be especially emphasized that on coating the supports with the new compound foil an absolutely satisfactory surface free from pores may always be guaranteed, even when very rough supports, for instance rough tissue have to be covered, this being due to the fact that the top layer cannot sink into the support or the rough surface of the support cannot press through the foil.

The following examples serve to illustrate the invention, but they are not intended to limit it thereto:

1. A foil of a thickness of 0.04 mm, obtained by the way of fusion process and prepared from super-polyamide which has been produced from caproic lactam is combined with another foil of a thickness of 0.03 mm, which has been prepared by casting an alcoholic solution of the mixed superpolyamide prepared from equal proportions of caproic lactam and the salt of hexamethylene-diamine with adipic acid, on a rough support, one side of the foil being mat. The two foils are combined by placing the first named foil which has been moistened with ethylene chlorohydrine to the smooth surface of the other foil and compressing both foils together by means of squeezing rollers. The compound foil thus produced is then dried on hot rollers. The finished compound foil is distinguished by the fact that in the presence of heat and with the aid of water as swelling agent it may be intimately combined with various kinds of supports. The layer of the mixed superpolyamide serves in this case as an abrasive layer. Webs of paper moistened for instance with water and a compound foil may be conducted together into a heatable calender, the temperature of the heated roller of which is at 150° C, so that this roller of the calender comes in contact with the paper. A paper is thus obtained which is covered with an intimately adhering lustrous coating of super-polyamide. If the temperature of the heated roller of the calender is raised beyond 200° C, or even to 300° C the same good results are attained. The coating material is, therefore, very insensitive to variations of the operating conditions. A tissue scarcely moistened with water may be combined in the same manner with the compound foil. Moistened plywood slabs may likewise be coated without any difficulty with the compound foil. In that case there is, however, operated in such a manner that the heated roller of the calender comes in contact with the compound foil. Instead of a calender a hot flat iron may be used for combining the compound foil with the various supports. If as a swelling agent aqueous ethyl alcohol of 20 per cent strength is used instead of water the combination of support and foil may be performed particularly rapidly and at a temperature still lower than that named above.

2. The superpolyamide obtained by the condensation of 3.5 parts of caproic lactam and 6.5 parts of the salt of hexamethylene-diamine with adipic acid is dissolved with application of heat in aqueous methyl alcohol. The solution thus formed is cast to a film of a thickness of 0.03 mm. A further solution of a mixed super-polyamide prepared with the same solvents—on preparing the said mixed super-polyamide the two aforenamed components having been applied in the proportion of 1:1—is cast on to the dried film so that a further layer of a thickness of 0.04 mm is produced. When applied for a covering process the latter layer serves as an adhesive layer. Various kinds of supports may be coated at a

temperature of about 100° C with the compound foil thus obtained having a thickness of 0.06 mm, after its adhesive side has been moistened with an aqueous ethyl alcohol of 20 per cent strength. Though the second layer of the compound foil, as regards its chemical composition, scarcely differs from the adhesive layer, it does not soften during said operation, even if a temperature far beyond 100° C is applied. The compound foil may be combined with supports consisting of paper, tissue or wood in the same manner as described in example 1.

3. A foil of a thickness of 0.01 mm is prepared in the following manner from superpolyamide obtained by the condensation of the salt of hexamethylene diamine with adipic acid: by a mechanical process the super-polyamide is given the desired shape at a temperature of about 280° C to 290° C, while excluding oxygen; the foil obtained is then dilated by a stretching process either in one direction or in all directions. The foil is then combined with another foil having a thickness of 0.05 mm, said latter foil having been prepared by casting from a mixed super-polyamide from 4 parts of caproic lactam and 6 parts of the salt of hexamethylene-diamine with adipic acid. The two foils are combined with the aid of ethylene chlorohydrine. The last-named foil serves as an adhesive layer when the material is applied. The compound foil thus made may be combined by means of aqueous ethyl alcohol of 20 per cent strength or an aqueous glycerin solution of 10 per cent strength, with application of heat, with various kinds of supports. Since the adhesive layer is relatively thick, support and foil are intimately united even in those cases where the support to be covered has a rough surface. Since, on the other hand, the layer of the compound foil not softening during the combining process is very thin, materials which possess a particularly high flexibility are obtained on using said compound foil for coating tissue. Pure ethyl alcohol may likewise be used as a swelling agent during the coating process. It is, however, suitable to operate with aqueous incombustible alcohol. A tissue which has been coated with the compound foil herein described may be boiled with water and the super-polyamide coating is neither separated nor damaged thereby.

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