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MOLDED PHENOLIC COMPOSITIONS AND PROCESS OF MAKING SAME.

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This invention relates to molded insulation of the type comprising a filling material, or inert base, such as wood flour, paper, fabric or the like, and an infusible phenolic resin binder; and comprises a novel product of this type characterized by a relatively high insulating value at elevated temperatures. The invention comprises also a process of heat-treating molded phenolic compositions to improve their insulating value. The term "molded phenolic compositions" is used herein in a broad sense to include all such products as result from the molding of commercial molding mixtures; laminated products formed by the consolidation under heat and pressure of superposed sheets of paper, fabric or the like which have been coated or impregnated with a reactive phenolic resin; and all similar products or articles.

According to the present invention the molded phenolic composition, in the state in which it comes from the press and under the present practice is ready for the trade, that is to say, in the so-called "cured" condition, as distinguished from the uncured products of so-called cold-molding or quick-molding operations, in the state in which they are ready for subjection to the after-baking step, is subjected to a further heat-treatment or after-curing process, whereby its insulating quality, especially when measured at elevated temperatures of the order of 100° C., is greatly improved. This treatment will naturally vary somewhat according to the size and nature of the article; but the conditions now preferred for molded articles of ordinary dimensions, as well as for laminated sheets or tubes, comprise heating at a temperature of about 125°–135° C. for a period upward of 48 hours, and preferably 70–80 hours. The invention is not limited to these particular times and temperatures, since time and temperature are within reasonable limits co-related factors; and a more prolonged treatment at a somewhat lower temperature range, or conversely a shorter treatment at a somewhat higher temperature, may be expected to accomplish, at least in part, the same results. The conditions stated are however those which have been found most desirable in practice; and temperatures of the order of 100° C. have not been found effective even when maintained for relatively long periods.

Molded phenolic compositions to which this treatment is applicable ordinarily vary rather sharply with the temperature in their insulating quality, or dielectric strength, as measured by determining the volts per mil at which the sample will puncture when subjected to a gradually increasing voltage stress in accordance with the standard procedure of the American Society for Testing Materials; the insulating value, commonly referred to as the "dielectric strength," being at 100° C. only a fraction, usually of the order of 10 to 25 per cent, of its value at room temperatures. An important effect of the above described heat-treatment is to yield a product having at 100° C. a dielectric strength approximating much more closely to the dielectric strength measured at normal temperatures. Articles properly treated in accordance with this invention exhibit a dielectric strength at 100° C. which is upward of fifty per cent of their normal dielectric strength in the non-treated state at 20° C., and in many cases 70–80%, or even 100% of this value. In exceptional cases higher values are observed, but this usually occurs when the dielectric strength of the untreated product is abnormally low.

The effect of the above-described heat-treatment upon the dielectric strength at normal temperatures, commonly referred to as the "dielectric strength-cold," is much less marked, and may even be negligible from a practical viewpoint when the molded composition has been so compounded and fabricated as to possess initially a very high cold dielectric strength. On the other hand, when the article, owing to causes not definitely determined, exhibits an abnormally low cold dielectric strength, the effect of the described treatment is to improve this value, raising it to or above the standard cold value. It will of course be understood that in those cases where an abnormally low cold dielectric strength is due to porosity of the article no marked improvement can be expected from the heat-treatment.

Since the molded phenolic compositions whose treatment is contemplated herein may vary widely in dielectric strength with va-

riations in proportion and nature of the filler or binder, with the molding conditions, as well as with many other factors, it is not practicable to give absolute average values indicating the effects of the treatment; in a typical case however a hot-press molded test sheet from a commercial black molding mixture known as #420 gave results as follows:

	Before treatment		After treatment	
	°C.	°C.	°C.	°C.
Temp. of test	20	100	20	100
Volts per mil	505	60	550	428

In this particular case therefore the dielectric strength of the untreated material at 100° C. was about 12% of its value at 20° C.; whereas after treatment the dielectric strength at 100° C. was nearly 85% of the original cold value, and over 75% of the cold dielectric strength of the treated article. These values are approximately representative for a large class of products, but are not to be regarded as restrictive of the invention.

The usual molding temperature for such of these molded phenolic compositions as are molded in the hot press (as distinguished from the so-called "cold-molding" process) is upward of 150° C.; it will be noted therefore that the preferred heat-treating or curing temperature according to this invention is near the normal hot-molding temperature. It is also below the usual after-baking temperature of the cold-molding process.

This invention is to be clearly distinguished from the after-baking step of the so-called cold-molding or quick-molding processes, which is applied to uncured molded products, and has for its purpose the accomplishment of the reaction of condensation, which reaction takes place, in the hot-molding process, in the press and during the act of molding. The heat-treatment of the present invention is applied to cured products, meaning thereby molded products which have undergone this condensation reaction, either during molding or subsequently thereto.

I claim:—

1. Process of heat-treating molded phenolic compositions to improve their insulating quality comprising subjecting the molded cured product to predetermined prolonged heat-treatment at a temperature below the normal molding temperature.

2. Process of heat-treating molded phenolic compositions to improve their insulating quality comprising subjecting the molded cured product to predetermined prolonged heat-treatment at a temperature of about 125°–135° C.

3. Process according to claim 1 in which the molded cured product is heat-treated at about 125°–135° C. for at least 48 hours.

4. As a new article of manufacture, a molded phenolic composition having a dielectric strength measured at 100° C. which is at least fifty percent of the dielectric strength of the same material measured at 20° C.

5. As a new article of manufacture, a molded phenolic composition having a dielectric strength measured at 100° C. which is at least seventy percent of the dielectric strength of the same material measured at 20° C.

6. As a new article of manufacture, a laminated article having a phenolic resin binder, said article possessing a dielectric strength measured at 100° C. which is at least fifty percent of the dielectric strength of the same material measured at 20° C.

7. As a new article of manufacture, a laminated article having a phenolic resin binder, said article possessing a dielectric strength measured at 100° C. which is at least seventy percent of the dielectric strength of the same material measured at 20° C.

In testimony whereof, I affix my signature.

GILBERT L. PEAKES.