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PROCESS OF MAKING CARBONACEOUS ELECTRODE PASTE

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In the production of so-called electrode paste for either the continuous or prebaked type of electrodes, the usual procedure is to crush the dry substance which may consist of anthracite, pitch coke, petrol coke or the like, and after grading the material according to size it is customarily blended to a preferred specification. In this blending it is customary to include both fine material and coarse material in predetermined proportion. The fine material (sometimes referred to as "fines") is usually fine enough to pass through a 100-mesh screen and preferably is fine enough so that a substantial part (say 40% or more) will pass through a 200-mesh screen. The coarse material will all be held by a 200-mesh screen and most of it will be held by a 100-mesh screen. The maximum size of the coarse material is usually such that the material will pass through a 1/2-inch screen though some slightly larger material may be employed. In many instances the coarse material is itself separated into two grades. For example, that which is held back by a 16-mesh screen and that which passes through such a screen. The desired proportions of the different fractions are customarily mixed in a dry state and a binder is added such as tar or pitch and the whole mass is mixed in a usual type of mixing machine.

It is an important factor in making a good paste of this type that the particles of dry material be thoroughly wetted. With the material that is coarse enough to be held back by a 100-mesh screen, this offers little difficulty. However, with the fine material (and particularly the portion which will pass through a 200-mesh screen) there is a tendency for the particles to ball up and a homogeneous mixture is not obtained.

If a poor moistening of the fines is had, an electrode paste of low quality is obtained which will not have the necessary mechanical strength and density. For example, if an electrode containing fines that are not properly wetted is used in the electrolytic production of aluminum, there is a tendency for foaming to take place and the bath will contain noticeable amounts of the fine dust sometimes referred to as soot.

It is recognized that this difficulty in wetting the fines is due to the adsorption of air on the surface of the separate particles. With the larger particles the ratio of surface to mass is such that the adsorption is not important but with very fine particles the layer of air adsorbed on the surface is in such a high ratio relative to the mass of the particles themselves that the wetting action is greatly impeded. Further it has been found that once these fines are formed with an air layer on their surface, the difficulty of removing or eliminating this air layer (even by use of vacuum) is so great as to be substantially impracticable.

According to the present invention, this difficulty is overcome by starting with solid masses or lumps (not aggregated particles) of the dry material of appreciable size, certainly large enough to be held back by a 100-mesh screen and preferably averaging much larger. As

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previously stated, the amount of air carried by these lumps will be small relative to their mass. Fluid which is compatible with the liquid binder to be employed is then mixed in with these relatively large pieces of solid material and they are then ground. The fluid employed may be a gas, as for example a gaseous hydrocarbon such as the petroleum hydrocarbons, for example propane, which displaces all the air but it is ordinarily simpler to use a liquid which will cling to the solid particles and coat them as the finer particles are formed, thereby preventing the air adhesion. For this purpose we may for example use hydrocarbons in liquid phase such as tar, pitches, anthracene oil, toluene and trichlorethylene or mixtures. The amount of fluid material used should be enough to wet the surface of the formed particles but not enough unduly to thin the binder later added. Usually between 2% and 10% of liquid may be employed.

The solid materials wetted with such a fluid is put in an appropriate mill such as a ball mill, pendulum mill or the like and ground down to the desired fineness which as previously stated is such that the material will pass through a 100-mesh screen and preferably such that 40% or more will pass through a 200-mesh screen. I have found that by starting with solid lumps of appreciable size (that is actual solid masses of the material and not aggregates of finer particles) and by actually fracturing these masses in the presence of the compatible liquid the adhesion of air on the surface of the produced particles is reduced to the point where ready wetting takes place upon the addition of the binder.

After the material has reached the desired degree of fineness it is mixed with coarser material in the proportion usually of between 35% and 60% of fine material with from 65% to 40% of coarse material, and an appropriate amount of binder is added which may range from 10% up to 35% depending upon the consistency of the material to be produced. As stated above the coarse material that is mixed in will be of such size that most of it will be held by a 100-mesh screen but will largely pass through a 1/2-inch screen. The binder is of the usual type of tar or pitch customarily employed in making electrode pastes as is well known in the art. Such materials ordinarily will have a melting point of between 40° C. and 130° C. and are mixed with the solids in molten form.

By following this procedure, results are obtained which are exceedingly valuable, as it has been found that this method of preparing the fine grains makes possible a considerable reduction in the quantity of binder which otherwise must be used to obtain the desired viscosity of the electrode paste. It has also been found that a considerably improved paste is obtained which gives the electrode much better mechanical qualities and density.

Thus for the purposes of comparison an electrode was prepared in the usual manner for use in the Soederberg process employing petroleum coke and 28.5% binder. This electrode had a specific weight of 1.36 and had a pressure resistance of 220 kgs./cm.². This is to be compared with another electrode of the same type using fines prepared in accordance with this invention and only employing 21% of binder and having a specific weight of 1.45. Ordinarily reducing the amount of binder would tend to weaken the electrode but in this case the electrode had a pressure resistance of 300 kgs./cm.². In another case using calcined anthracite and 20% of binder the electrode prepared in the usual manner had a specific weight of 1.38 and a pressure resistance of 170 kgs./cm.² as compared with an electrode prepared in accordance with this invention using only 14.7% of binder which had a specific weight of 1.45 and a pressure resistance of 340 kgs./cm.².

In order that the method of carrying out my invention may be thoroughly understood the following illustrative example is given:

Petroleum coke, all of which was retained on a 100-mesh screen and which included aggregates as large as 5 1/2-inch in diameter and even larger was mixed with about 5% anthracene oil and ground in a ball mill until it contained between 50% and 70% of material that would pass through a 200-mesh screen. Substantially 10 all of the material would pass through a 100-mesh screen. These fines were then mixed with coarser material (material that would pass through a 1/2-inch screen but would be retained on a 100-mesh screen) in the proportion of about 45% of the fine material with about 55% of the coarse material. 21% of tar pitch having a melting point of about 90° C. was then added and the mass 15 was thoroughly mixed at a temperature high enough to maintain the binder in fluid state. The resulting paste was then cooled and allowed to harden and broken into pieces for use as "paste" in Soederberg electrodes.

The advantages obtained by our process are obvious. Because of the reduced quantity of binder required, a cheaper electrode may be produced. Further, a smaller quantity of binder means that the amount of volatile constituents driven off during baking of the electrode will be considerably lower than has heretofore been the case. This reduction of volatile constituents is important both because of the effect of tar fumes on the workers where the electrodes are used and also their effect on neighboring vegetation. It has also been found that these effects 20 give greatly improved economy of operation because the improved strength and density of the electrodes will reduce electrode consumption and generally improve the economy of the smelting processes.

This application is a continuation-in-part of our earlier application Serial No. 276,434, filed March 13, 1952, now abandoned. 35

What we claim is:

1. In the production of electrode paste the steps of mixing carbonaceous material in lump form selected from the group consisting of anthracite coal, pitch coke and petroleum coke the major part of which is retained on a 100-mesh screen with an organic fluid material miscible with the binders used in making such electrodes selected from the group consisting of fluid petroleum hydrocarbons, and trichlorethylene, submitting such mixture to a grinding operation so that as the lumps are fractured 40

newly exposed surfaces are immediately wetted with said fluid material and adsorption of air on such faces is kept to a minimum, continuing such grinding until a mass of fines is obtained that will pass through a 100-mesh screen and 40% or more will pass through a 200-mesh screen, mixing such fines with material of the same nature that passes through a 1/2-inch mesh screen but is retained on a 100-mesh screen and combining with such mixture from 10% to 35% of binder selected from the group consisting of tars and pitches.

2. A process as specified in claim 1 in which the organic fluid material mixed with the carbonaceous material is at the temperature of mixing liquid.

3. A method as specified in claim 1 in which the binder has a melting point between 40° C. and 130° C. and is mixed with the carbonaceous material in molten form. 15

4. In the process of preparing carbonaceous material for use in electrodes selected from the group consisting of anthracite coal, pitch coke or petroleum coke which comprises grinding integral lumps of such carbonaceous material that will not pass through a 100-mesh screen down to a size fine enough to pass through a 100-mesh screen, the improvement which comprises grinding at substantially normal pressure and in the presence of an organic fluid material miscible with the binders used in making such electrode, selected from the group consisting of fluid petroleum hydrocarbons and trichlorethylene, whereby the new surfaces of such carbonaceous material resulting from such grinding are wetted promptly as 20 formed whereby adsorption of air on such surfaces is largely prevented, and maintaining the fluid present to protect the surfaces from adsorption of air until a binder is admixed with the carbonaceous material. 30

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