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MANUFACTURE OF ALKALI METAL CYANIDE

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This invention relates to an improved process for the manufacture of alkali metal cyanides.

It is well known to prepare alkali metal cyanides, e. g. sodium cyanide, by reacting carbon with the alkali metal and ammonia or with the alkali metal amide at a red heat, preferably in the presence of iron. In commercial operation the carbon used is normally a wood charcoal, and hitherto forms of carbon derived from coal have not been considered suitable for use in the process.

The object of this invention is to devise a method of manufacturing such cyanides utilising carbon derived from coal. A further object is to devise a method of preparing carbon from coal in such a form that it will be useful for the manufacture of such cyanides and for other processes which require carbon in a similar highly reactive form. A further object is to provide carbon from coal in a highly reactive form. Further objects will appear hereinafter.

These objects are accomplished by the following invention. I have discovered that by carbonisation of a coal which is preferably of low ash content and high in vitrain and durain, at temperatures in the neighbourhood of 450–650° C. and preferably between 500° and 600° C., a form of carbon is obtained which is sufficiently reactive and is otherwise suitable for the manufacture of alkali metal cyanides by reacting it with ammonia and alkali metal, or with an alkali metal amide.

According to the invention, therefore, alkali metal cyanides are manufactured by reacting an alkali metal and ammonia, or an alkali metal amide, with carbon prepared by the carbonisation of coal which is preferably of low ash and high vitrain and durain content, the carbonisation being effected between 450° C. and 650° C. and preferably between 500° C. and 600° C.

To obtain the best results, careful control should be observed in the selection of coal for carbonisation, due to possible mechanical difficulties, and in order to minimize introduction of impurities into the product. Thus it is desirable to choose a low rank coal with a durain content of from 50–60% which is not excessively friable and in which the durain is distributed in thin bands alternating with the vitrain; fusion of the coal does not then occur during carbonisation, and yet the durain provides a binder for the bright friable plates into which the vitrain is converted, and the resulting mass is porous, but not too friable. Again, in view of the purpose for which the carbonization product is required, the sulphur contents should be low. Typical coals which conform to these requirements are those known as "Hucknall High Hazel" and "Eastwood", while on the other hand such a coal as "Pooley Hall" is too friable, though it conforms to the other criteria given above.

The coal may be subjected to the carbonization without any pretreatment beyond the usual washing, grading and like operations, though preferably the coal is in the form of dust-free nuts and is subjected to a preliminary heat treatment at about 100° C. for 2–4 hours to dry it and remove readily volatile matter. The carbonization is then performed slowly enough to avoid cracking oils in the coal and thus impair the reactivity of the product. Tarry vapours should be removed from the carbonization zone as speedily as possible, and to this end the coal may be treated with steam during the carbonization; conveniently the coal is treated in shallow layers on trays in a horizontal retort for the same reason.

As has been stated above, in order to obtain a product of satisfactory reactivity the temperature of carbonization should be between 450 and 650° C., preferably between 500 and 600° C., and then the treatment should be continued for not more than about 4 hours while in general as little as 1 hour is sufficient. With shorter times carbonization is incomplete, while with times greatly in excess of 4 hours I find that the reactivity of the coal is adversely affected. I do not find that much variation in the above temperatures and times is required to give satisfactory results with the different coal within the scope of my invention.

The carbonization product may be reacted with alkali metals and ammonia or with alkali metal amides by any of the methods which have hitherto required wood charcoal for their successful operation; for example the alkali metal, e. g. sodium may be fed in at the upper end of a column of charcoal maintained at a red heat, while a current of dry ammonia gas is passed in from below. Alternatively if the amide is to be used as the raw material, the molten amide, e. g. sodium amide, is run onto an excess of the red hot charcoal. The preparation of the cyanide is then completed in the usual way.

The manner in which the temperature and the time required to produce a coal charcoal sufficiently reactive for the commercial production of cyanides is strikingly illustrated by trials which have been carried out on batches of washed coals. Average lots of a number of coals

of varying carbon content were carbonised by heating on shallow trays in a horizontal retort at temperatures of 400°, 500°, 600° and 700° C. for periods of 1, 1.5, 3 and 5 hours in each case. Each lot of coke obtained from these carbonisation runs was examined separately, when it was observed that only the cokes produced at temperatures of 500° and 600° C. were sufficiently active for the commercial manufacture of alkali metal cyanides, the best results being obtained at 500° C. Even with these materials there were differences which were apparently dependent on the duration of carbonisation. Thus the cokes resulting from the treatments carried out for 1, 1.5 and 3 hours reacted at rates which were substantially the same as those observed with wood charcoal normally used, whereas carbonisation for a period of 5 hours gave a material distinctly less reactive, the optimum period of carbonisation being about 2 hours. With regard to the other temperatures I found that the use of 400° C. was ineffective for the production of a suitable coke, while the material formed at a temperature of 700° C. was distinctly less reactive than those produced at 500° and 600° C.

I have found that a charcoal which has a high reactivity suitable for cyanide manufacture has also a high reactivity with oxygen so that a convenient method of testing the reactivity of the carbon produced is to place a block of the charcoal, weighing at least 25 grms. on a gauze over a Bunsen flame. A charcoal which is satisfactorily reactive for the production of cyanides should lose from 50 to 75% of its weight when 400 litres of coal gas (calorific value 475 B. Th. U./cu. ft.) have been burnt at the approximate rate of 250 litres per hour.

This invention is a valuable advance in the art as it makes it possible to use an initial raw material, hitherto regarded in commercial practice as unsuitable for the manufacture of alkali metal cyanide, and also to provide a complete process for the manufacture of such cyanides from carbon, ammonia and the alkali metal without the necessity for the use of the comparatively expensive wood charcoal. Furthermore the carbon manufactured from coal as described in this invention is useful for many other processes which depend on the adsorption properties of carbon.

As many apparently widely different embodiments of this invention may be made without departing from the spirit or scope thereof it is to be understood that I do not limit myself to the specific embodiments thereof except as defined in the appended claims.

I claim:

1. A process for the manufacture of alkali metal cyanide which comprises reacting an alkali metal amide with coke produced by carbonizing coal at a temperature of 450 to 650° C. for a period of time not exceeding six hours.

2. A process for the manufacture of alkali metal cyanide which comprises reacting an alkali metal amide with coke produced by carbonizing coal at a temperature of 450 to 650° C. for one to three hours.

3. A process for the manufacture of alkali metal cyanide which comprises reacting an alkali metal amide with coke produced by carbonizing coal having a high durain content at a temperature of 450 to 650° C. for one to four hours.

4. A process for the manufacture of alkali metal cyanide which comprises reacting an alkali metal amide with coke produced by carbonizing coal having a durain content of at least 50% by weight at a temperature of 450 to 650° C. for one to four hours.

5. A process for the manufacture of alkali metal cyanide which comprises reacting an alkali metal amide with coke produced by carbonizing coal having a durain content of 50 to 60% by weight at a temperature of 450 to 650° C. for one to four hours.

6. A process for the manufacture of alkali metal cyanide which comprises reacting an alkali metal amide with a coke produced by carbonizing coal having a high durain content, said durain being distributed in layers in said coal, at a temperature of 450 to 650° C. for one to four hours.

7. A process for the manufacture of alkali metal cyanide which comprises reacting an alkali metal amide with a coke produced by carbonizing coal having a durain content of 50 to 60% by weight, said durain being distributed in layers in said coal, at a temperature of 450 to 650° C. for one to three hours.

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