United States Patent Office 3,107,973 Patented Oct. 22, 1963

3,107,973
PROCESS FOR FORMING IMPERMEABLE CARBON ARTICLES

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No Drawing. Filed Nov. 15, 1960, Ser. No. 69,294
Claims priority, application Great Britain Nov. 20, 1959
3 Claims. (Cl. 18—54.7)

This invention relates to processes of making articles from carbon powder. The term carbon is to be understood to include graphite.

Known processes in the art of making carbon articles include bonding particles of carbon with binders such as synthetic resin or pitch and a subsequent carbonising step.

It has also been proposed to mix carbon powder with the binder to form slugs which are carbonised and pulverized to a finely divided state, the particles resulting being remixed with binder and the product again pulverised to secure a powder of uniform size. In making articles of such powder, charges of the powder are pressed to shape under pressures from 1000 to 20,000 p.s.i. and the product carbonised throughout by heat treatment.

The major disadvantage of the known processes is relatively great irregularity of pore size and distribution with the result that subsequent attempts to deposit carbon in the pores of such articles to reduce or substantially eliminate porosity may not always be successful or may be unduly tedious or expensive.

According to the present invention a process of making a carbon article comprises lightly consolidating in a mould a charge of carbon powder of which the particles are of very small size and subjecting the consolidated charge whilst in the mould to a carbon deposition process in which carbon is deposited by pyrolysis from a gas or vapour of a carbon compound throughout the charge to bond the particles together to form a unitary porous article, next removing the article from the mould and then repeating the deposition process to strengthen the bonds and render the article substantially impermeable.

The deposition step may consist of heating the consolidated charge to a temperature in the range 500° C. to 1500° C. whilst flowing the gas or vapour through the mould and excluding other gases at a pressure which is in the range sub-atmospheric to slightly about atmospheric.

The process may also include heating the article after deposition to graphitise the carbon.

The consolidation may be effected by vibration or pressure.

Two examples of performing the invention will now be described.

Example 1

A charge of dried lamp black was poured into a graphite mould treated with a parting agent and the mould was vibrated by tapping to lightly consolidate the charge.

The charged mould was put in a gas deposition furnace and treated by heating at 880° C. for four hours in a gas mixture of nitrogen and benzene, the partial pressure of

the benzene being 8 cm. Hg, whereby the lamp black particles became bonded together as a unitary but porous article conforming to the shape of the mould.

After this treatment the porous article was removed from the mould and was found to have an apparent density of 0.33 gm./cc. and to be strong enough to resist damage if handled with care. It was then placed in the deposition furnace and given a further gas deposition treatment at 860° C. for 16 hours which raised the density to 0.59 gm./cc.

Work pieces were then machined from the moulded article in the form of slabs and tubes and these were given further deposition treatment at 860° to deposit carbon in the pores throughout and raise the density to 1.55 gm./cc. and render them substantially impermeable.

Example 2

Lamp black was used as in Example 1 and the operating conditions were substantially the same. The example consisted of repeating the following cycle several times: charging the mould, consolidating the charge, depositing carbon in the charge, pulverising the moulded product to powder, sieving the powder to less than 300 mesh (B.S.S.), then re-charging with the sieved powder, etc. After several cycles the article resulting from the deposition step was subjected to mechanical test and found to have a bend strength of about 14,000 p.s.i. and compression strength of about 75,000 p.s.i. It is to be noted that comparable figures for conventional carbon material are about 4,000 p.s.i. and 8,000 p.s.i.

It is to be noted that the invention readily permits the manufacture of highly impermeable carbon articles having, for example, a permeability as low as 5×10^{-9} cms.^{2}/sec.

We claim:

1. A process for producing a substantially impermeable formed carbon article which comprises charging a mould with finely divided carbon powder of very small particle size, lightly consolidating the carbon powder in said mould, subjecting the consolidated powder charge within said mould to a moving stream of a gaseous hydrocarbon while at a temperature in the range 500–1500° C. and at a pressure in the range sub-atmospheric to just above atmospheric to bond the carbon powder into a unitary, porous, formed carbon article, removing the formed unitary carbon article from the mould, subjecting the formed carbon article to at least one more treatment with said gaseous hydrocarbon at a temperature within the range 500–1500° C. and at a pressure within the range sub-atmospheric to just above atmospheric to produce a substantially impermeable carbon article.

2. A process in accordance with claim 1, wherein the formed carbon article is subjected to two treatments sequentially with the gaseous hydrocarbon.

3. A process for producing a substantially impermeable formed carbon article which comprises charging a mould with finely divided carbon powder of very small particle size, lightly consolidating the carbon powder in said mould, subjecting the consolidated powder charge within said mould to a moving stream of a gaseous hydrocarbon while at a temperature in the range 500–1500° C. and at a pressure in the range sub-atmospheric to just above atmospheric to bond the carbon powder into a unitary, porous, formed carbon article, removing the formed uni-

tary carbon article from the mould, pulverizing the formed carbon article to powder, passing the powder through sieve means of less than 300 mesh, charging a mould with said sieved carbon powder, lightly consolidating the sieved carbon powder in said mould, subjecting the compacted sieved carbon powder within said mould to a moving stream of gaseous hydrocarbon under the conditions enumerated for the first treatment with a gaseous hydrocarbon to bond the carbon powder into a unitary, formed carbon article, subjecting the formed carbon article to at least one more treatment with said gaseous hydrocarbon at a temperature within the range 500–1500° C. and at a pressure within the range sub-atmospheric to just above atmospheric to produce a substantially impermeable carbon article.

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