United States Patent Office 2,965,684
Patented Dec. 20, 1960

2,965,684

PROCESS FOR THE STORAGE OF ACETYLENE

Otto Fruhwirth and Eduard Pichl, Burghausen, Upper Bavaria, Germany, assignors to Wacker-Chemie G.m.b.H., Munich, Germany, a German firm

No Drawing. Filed Mar. 31, 1959, Ser. No. 803,104

Claims priority, application Germany Apr. 3, 1958

4 Claims. (Cl. 260—665)

The present invention relates to an improved process for the storage of acetylene by addition of acetylene to water-containing potassium hydroxide.

It is difficult to transport and store acetylene due to its tendency to decompose with increasing amount, especially since the development of the petrochemical manufacturing processes, which on account of the devices necessary for working up the by-products formed, are of a stationary nature. Explosive decomposition may take place in pipes of 38 mm. internal diameter already at a pressure of 1.2 atm., in pipes of 66 mm. internal diameter already at 0.80 atm., in containers of 250 mm. internal diameter at a pressure of 0.50 atm.

Up to now it was only possible to transport acetylene in steel cylinders, the acetylene being dissolved in acetone and the latter being absorbed by porous masses. However the weight of a steel cylinder with an acetylene content of 6 kg. amounts to approximately 70 kg. Thus only 10% of the transport weight can be utilized for the transportation of acetylene. Other suggestions, such as converting the acetylene by cooling to a temperature of below —81° C. into a solid state of aggregation or storing liquid acetylene in a pressure tank under constant cooling, or storing concentrated acetylene solutions at from —80° to —120° C., could not be realized because of the danger of explosion and high expenses involved.

There has been found a method which makes it possible to store acetylene and/or acetylene derivatives as such or acetylene from gas mixtures. The stored acetylene may be re-gasified by the action of small quantities of water.

The process according to the invention consists in reacting acetylene or acetylene containing gas mixtures in the absence of solvents with water-containing potassium hydroxide within a range of temperature of from 50° to 100° C. The resulting reaction product acts similarly to calcium carbide and may be stored, transported, gasified and the resulting caustic alkali re-employed for the storage of acetylene without danger.

The new method makes it possible to work up acetylene independent from its place of production.

The speed of reaction increases with the rise of temperature and can be utilized practically at about 50° C. It is advisable however not to exceed a temperature of substantially 100° C., as it is known that in such a case acetylene will be condensed by alkalines to form vinylacetylene and other homologues. The reaction temperature depends also on the water content of the potassium hydroxide employed and on the rate of addition, as during the reaction of acetylene with sodium hydroxide one mol of water is freed and linked to the residual potassium hydroxide. The melting point is being lowered as the water content increases. Optimum reaction conditions are given when the water content of powdered potassium hydroxide is about 10% and the range of temperature from 50° to 100° C.

Acetylene is picked up with great velocity when potassium hydroxide is employed, whereas the velocity is much

lower when sodium hydroxide and lithium hydroxide are used.

In order to avoid gumming of the reaction product in spite of a higher water content, it is advisable to add water binding agents or lean material, such as potassium carbonate, calcium oxide, chalk, powdered quartz and so on.

The acetylene pick-up may be raised considerably by the addition of loosening agents, such as for instance kieselguhr, fibrous material, such as asbestos fibers, cellulose and the like.

Thus it is possible to obtain in a one-step procedure a final product from potassium hydroxide having a water content of 10% which yields during the gasifying 150 g. of acetylene per 1 kg. of addition product. In order to obtain a higher acetylene content it is necessary to remove the formed reaction water completely or partially which may be effected simply by evacuation at the reaction temperature.

Thereafter acetylene may be re-added, whereby an acetylene content of 200 g. per kg. may be achieved, which corresponds to 50% of the theoretical amount. It is not advantageous to add more than 300 g. per kg. The speed of addition slows down considerably when material of a high percentage is used and it is more difficult to handle the resulting addition product.

Gasifying the addition product of acetylene to potassium hydroxide may take place in a simple way by adding the amount of water necessary for the decomposition. The water should be added to the reaction product according to conventional methods.

Furthermore it is necessary to separate off the heat developed as quickly as possible in order to avoid liquifying the degasifying product and to avoid thus the formation of foam. It is of advantage to use for this purpose a mixing and kneading machine, which is cooled externally in order to dominate a temporary pasty or sticky consistency of the decomposition product. It is advisable to use also for this purpose additives which act as lean material or antifoam agents, such as potassium carbonate or kieselguhr. The resulting potassium carbonate may be employed again for the addition of acetylene. By the reaction of potassium hydroxide with acetylene and its derivatives respectively it is made possible to remove acetylene completely from the gas mixture containing e.g. olefines, paraffines, nitrogen, hydrogen and so on. The separation of acetylene from these gas mixtures according to this method is more complete than with solvents or absorption agents according to known methods. In order to maintain the speed of reaction high enough it is advisable to carry out the reaction under low additional pressure.

The following examples will serve to illustrate several embodiments of the process according to the invention.

Example 1

Potassium hydroxide with a water content of 30% was treated with acetylene in a rotary tube at a temperature of 60° C. While the pick-up of acetylene took place very rapidly at the beginning, it slowed down gradually and stopped after obtaining 40% of an addition content of acetylene. The reaction product was slowly reacted with 18 parts by weight of water in a mixing and kneading machine cooled externally, whereby the acetylide was decomposed completely under the formation of acetylene and potassium hydroxide with a water content of 35% was obtained which could be re-used for the reaction of acetylene.

Example 2

Powdered potassium hydroxide containing 10% of water was treated with acetylene in a rotary tube at a temperature of 70° C. The gas pick-up took place rapidly at the beginning, later the speed of reaction slowed

down gradually and stopped when a content of 150 g. acetylene per kg. of reaction product had been obtained. The addition product was passed from the rotary tube into a mixing and kneading machine cooled externally and 100 g. water per kg. addition product were added slowly and finely divided. The added amount of acetylene was obtained again completely, whereas potassium hydroxide was afterwards dried in the vacuum to a water content of 10% and re-employed in the addition process.

Example 3

Powdered potassium hydroxide with a water content of 10% and an addition of 10% by weight of kieselguhr was reacted with a gas mixture consisting of 40% acetylene, 30% olefines, 25% hydrogen and 5% paraffines at a temperature of 60° C. and additional pressure of 0.5 atm. until a content of 120 g. acetylene per kg. reaction product had been reached. After that the reaction product was evacuated for ½ hour at a pressure of 2 mm. Hg and the heating of the reaction device was lowered to 30° C. Thereafter the gas mixture was passed again into the reaction device at a pressure of 0.5 atm. additional pressure elevating the temperature to 60° C. until the content of 180 g. acetylene per kg. addition product had been obtained. Decomposition took place in the manner

described above adding 130 g. water per kg. reaction product.

We claim:

1. A process for the preparation of acetylene for storage, which comprises reacting acetylene with potassium hydroxide having a water content between 10 to 40% in the absence of organic solvents at a temperature from 50 to 100° C. to form a storable addition product from which acetylene may be regenerated by the addition of water.

2. The process according to claim 1 comprising in addition removing the water formed during the reaction.

3. The process according to claim 1 in which said reaction is carried out in the presence of a water binding agent.

4. The process according to claim 1 in which said reaction is carried out in the presence of a water absorbing agent.

References Cited in the file of this patent

UNITED STATES PATENTS

2,422,251	O'Brian et al.	June 17, 1947
2,455,058	Herman	Nov. 30, 1948