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An Investigation of Carbon Deposition

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During the three months covered by this report a major amount of the effort was expended on devising modifications for the induction furnace to overcome various problems. Work was also continued on the pore structure characterization methods.

1. Induction Furnace

As reported previously, with the initial design of the furnace it was possible to obtain temperatures only up to about 2000°K instead of the desired 3000°K. A program of modifications was therefore undertaken to achieve higher temperatures.

The first step was the use of tantalum radiation shields surrounding the carbon cylinders. These were fabricated in cylindrical shape with a slit so as to prevent circulation currents and permit observation of the carbon (and char) cylinders by the optical pyrometer. With the use of two concentric shields, a maximum cylinder temperature of approximately 2600°K was achieved.

The next step was to use cylinder holders fabricated from boron nitride, rather than the pyrolytic graphite ones which had been used previously. The first test with these holders resulted in failure at 2000°K because of the low thermal strength of boron nitride. Holders with greater thickness are presently being fabricated in order to alleviate this problem.

A continuing problem has been the accurate determination of surface temperatures with the pyrometer. This is because of the deposits which form rapidly on the quartz cylinder during any run - even when no decomposition reactions are taking place in the porous medium. An attempt has been made to alleviate this problem by blowing a small jet of nitrogen along the portion of the surface through which the observations are being made. During the first trial the direction of nitrogen flow was such as to accentuate rather than correct the problem. A revision in the flow direction is being made to give this approach another try.

The other approach to this problem which is being considered is the installation of a small diameter quartz tube on the inside of the large tube containing the carbon or char cylinder. The use of this "sighting" cylinder, possibly with a small outward flow of nitrogen (in the direction of the carbon cylinder) should correct the situation. The only anticipated problem may be some stress distortion at the point of attachment of the small tube.

2. Pore Structure Characterization

Several pore size distribution measurements have been made with the newly-received Aminco porosimeter. These have been performed on commercial carbon which is specified as having an average pore size diameter of 25 microns. The measurements confirm that the major portion of the pores of this material are within the range 22 - 36 microns.

Measurements of internal surface area of the same material using the Sor-BET apparatus have yielded surface areas of approximately one square meter per gram. The isotherms are of the expected BET type.