NASA TECH BRIEF

Langley Research Center

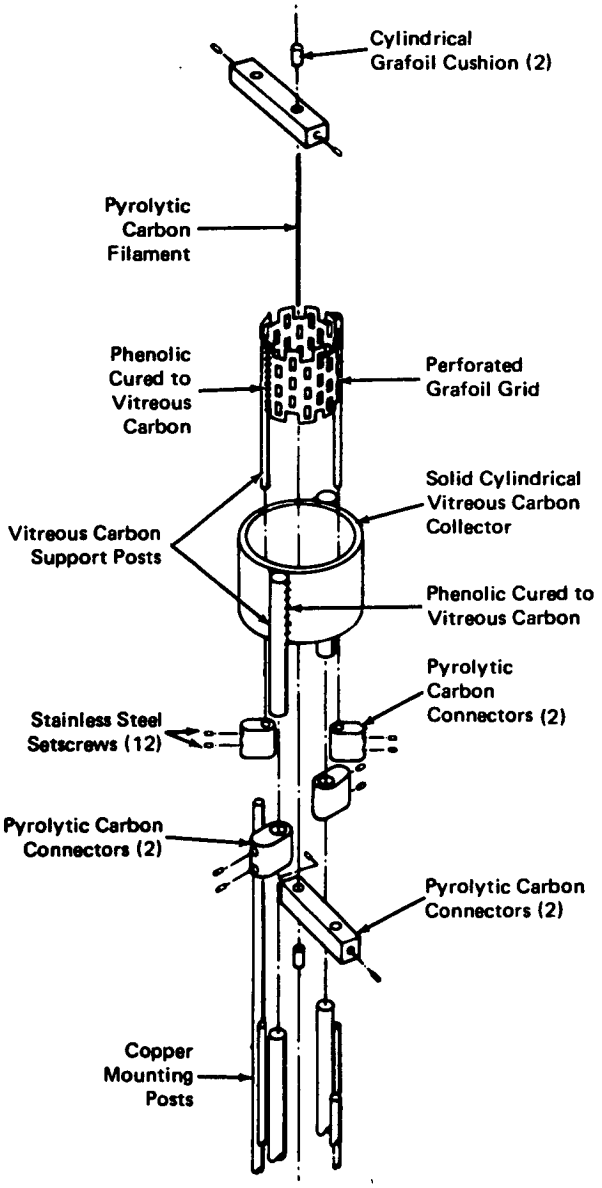
Graphite Ionization Vacuum Gauge

A triode gauge with the electron source (filament), the electron collector (grid), and the positive ion collector (collector) made from either graphite or carbon material, instead of the usual metals, is shown in the illustration. This technique extends the low-pressure ranges of existing gauges by changing only the materials used in construction.

While the graphite gauge is in the normal triode configuration, any other gauge design can be built to take advantage of the useful properties of carbon and graphite. Besides vacuum pressure gauges, mass spectrometer ion sources can be built from carbon. This can be especially advantageous in the smaller, simpler mass analyzers which are plagued by spurious surface peaks.

The advantages of a graphite ionization vacuum gauge stem from the physical properties of graphite (or carbon). Carbon has one of the lowest X-ray production cross sections of all the elements, and the work function of carbon remains high. These two properties combine to reduce the gauge X-ray background (residual currents arising from photoelectrons ejected from the collector by X-rays produced at the grid) by at least an order of magnitude.

The sticking probability of hydrogen on carbon or graphite is so low that the generation of atomic hydrogen is negligible, and therefore, atomic hydrogen-related chemical reactions are negligible. The sticking probabilities of hydrogen, carbon monoxide, carbon dioxide, and nitrogen on carbon are all orders of magnitude lower than on metals. Also, saturation surface coverages of adsorbed gases are orders of magnitude lower on carbon than on metals. This results in a vacuum gauge with reduced memory, no pumping, and lower spurious ion currents caused by electron desorption of adsorbed gases.



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(continued overleaf)

Notes:

1. The following documentation, which includes construction and performance characteristics, may be obtained from:

   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $1.45)

   Reference: NASA CR-2101 (N72-31463), Development and Evaluation of Vacuum Pressure Gauge Components From Carbon and Graphite
2. Technical questions may be directed to:

   Technology Utilization Officer
   Langley Research Center
   Mail Stop 139-A
   Hampton, Virginia 23665
   Reference: B74-10136

Patent status:

NASA has decided not to apply for a patent.

Source: George A. Beitel and
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