NONDESTRUCTIVE TESTING: II.
X-RAY IMAGING OF GRAPHITE AND GRAPHITE PRECURSORS

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The purity and structural uniformity of specialty grade graphite must be very high, and many applications of these high quality materials require that each individual piece be tested. Purity tests can be made from statistical approaches. However, structural uniformity quality control must be performed on each end use piece, and these quality control tests cannot be destructive ones. Therefore non-destructive test methods must be used, and these methods must 1) identify any structural defects which would adversely affect performance of the material in a particular application, and 2) permit indentification of these defects at significant resolutions.

X-ray imaging is one technique of quickly finding, classifying and analyzing structural defects both in graphite precursors and in final graphite products.

The apparatus which was used in these studies is a 250 KV X-Ray unit manufactured by Diano Corporation.

Standard graphite blocks made from coarse grain and fine grain graphites were used as reference materials. To determine the resolution of the instrument on these materials, holes of various sizes were drilled into these graphite blocks. The blocks were then X-rayed, and instrument settings were noted which allowed the resolution of void-type defects in size ranges set by the sizes of the drilled holes. The holes were then filled with ungraphitized carbon dust, with ungraphitized carbon rods, and with graphite rods which had been graphitized to different temperatures, and the instrument settings for resolution of impurity-type defects in graphites were noted. Resolution of defects in these graphite structures is related to grain size in the base graphite materials. Therefore photomicrographs of the graphite structures were made, and graphite particle size as measured from these photomicrographs is related to resolutions which are possible in coarse and fine grain graphite.

A non-destructive test method such as X-ray imaging can be very useful in determining the uniformity of a cabon or graphite material prior to impregnating it with some non-carbonaceous material, particulary metals. Standard carbon blocks with various size holes drilled in them were used to correlate instrument resolution with void-type discontinuous areas in these blocks, enabling these discontinuous areas to be detected prior to incorporation of metals throughout the billet.

In order to study the utility of X-ray imaging on graphite/metal composites, graphite blocks which had been impregnated with metals and had various size holes drilled in them were used. Again, resolution limits on these materials were found by noting instrument settings at which the holes, which would correspond to unimpregnated or discontinuous areas, could be seen.