ABSTRACT

"Experimental Fabrication of Pyrolytic Graphite Using Acetylene as a Principal Source Gas"

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Studies have been conducted on the fabrication of free-standing shapes of pyrolytic graphite using commercial acetylene as one of the principal source gases. The range of processing conditions investigated covered the area normally employed to produce pyrolytic graphite free-standing components using convention techniques, i.e. using methane or natural gas as the principal carbon source. The study covered two phases. The first phase was to determine the effects of deposition pressure, acetylene/methane gas mixture ratios and deposition temperature on the pyrolytic graphite deposits. In this phase it was found that (1) the deposition rate increased as the deposition pressure increased, (2) the deposition rate decreased as the deposition temperature decreased, and (3) the deposition rate increased as the C_2H_2/CH_4 ratio increased. It was also determined that the density of the deposits decreased markedly as the deposition temperature was lowered towards 1750°C. The most significant effect observed was the increased deposition rate obtained as the acetylene/methane ratio was increased. Considering all processing conditions studied, an increased acetylene/methane ratio in all cases increased the deposition rate. The density and the microstructures of each deposit was determined and found to be in the normal range for good pyrolytic graphite deposits. After the initial phase of this study was completed, Phase II was initiated. In this phase several free-standing nose tip configurations were fabricated. The nose tips fabricated has a substantial increase in deposition rate in the stagnation (tip) region over nose tips fabricated using convention techniques for producing un-alloyed pyrolytic graphite, and had a more uniform growth pattern along the length of the conical skirt. The growth pattern and the deposition rate obtained were superior to any previously obtained with unalloyed pyrolytic graphite. These results indicate that using acetylene as a carbon source may be commercially feasible, could yield a superior product, and could substantially reduce the number of hours required to vapor deposit free-standing pyrolytic graphite shapes.