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Author: Dr. Dafang Zhao
Chinese Academy of Equipment Command and Technology, China

A NEW SINTERING METHOD FOR ULTRA-HIGH-TEMPERATURE RESISTANT SI-AL-C FIBERS

Abstract

Polymer-derived SiC fiber is one of the most important reinforcing materials for high performance ceramic matrix composites (CMC). Ultra-high-temperature performance requirement is keeping proposed for CMC reinforcements with the development of aerospace technology. Among the strategies for improving the high-temperature performance, the most accessible method is to prepare near-stoichiometric SiC fiber by introducing small amount of aluminum (Si-Al-C fiber) through ultra-high-temperature sintering. Si-Al-C fibers show an excellent thermal stability up to 1900 degree C, a good oxidation resistance, an excellent chemical corrosion resistance and creep resistance . Commonly, the Si-Al-C fibers were derived from polyaluminocarbosilane (PACS). PACS was melt-spun, and the spun fibers were cured in the air where oxygen was introduced to the fibers. The cured fibers were pyrolyzed in inert gas up to 1300 degree C to get Si-Al-C-O fibers, which contains non-stoichiometric excess of carbon and oxygen. The Si-Al-C fibers were obtained by sintering Si-Al-C-O fibers at 1800 degree C in Ar. But, the oxygen content should be controlled strictly to get a desirable fiber in the method. In our work, a new sintering method was designed and studies. It demands lower oxygen content for cured PACS fiber. In addition, it can control decomposition of SiCxOy phase and densification process. The sintering method can be interpreted as follows: a cured PACS fiber was continuously pyrolyzed at the range of 1500-1600 degree C, where SiCxOy phase decomposed slowly; The obtained fiber was continuously sintered at about 1800 degree C where the fiber can be densified. The SA type SiC fiber prepared this way can avoid grain coarsening with good reproducibility. The strength reservation of the obtained fiber is 77% after been heated at 1800 degree C for 1hr in Ar.