OPTIMIZING RMI ATMOSPHERE FOR SiC/SiC COMPOSITES FABRICATION

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The reactive melt infiltration “RMI” process is expected to be an inexpensive manufacturing method for SiC/SiC composites which are considered to be applied much for aero-engine component application in order to improve fuel efficiency. One of the keys of RMI process is wetting behavior of molten Si on the SiC and Carbon because molten Si infiltrates into the preform, consisting of SiC particles and Carbon, by the capillary force. Another key is to suppress the evaporation of Si vapor during RMI.

Gases in the furnace should have low dew point in order to decrease the oxidation potential of infiltration atmospheres. When molten Si infiltrates into the preform at 1470℃, then the dew point for hydrogen should be less than 45℃ in order to prevent Si from oxidation, The dew point is equivalent to about 1×10^{1}Pa level of water vapor and 1×10^{1}Pa can be obtained in the vacuum furnace even by an oil rotary vacuum pump. On the other hand, at high vacuum atmosphere Si vapor evaporates and the evaporation could damage the furnace. Then a continuous flow of high purity argon was introduced into vacuum in order to suppress the evaporation. The flow rate effects on the wetting behavior and Si evaporation behavior were investigated.

The atmosphere pressure was controlled by the Ar gas flow rate, and the evaporation of Si vapor was found to be suppressed at 1×10^{2}Pa or higher pressure. And good wettability was obtained at less than 1×10^{2}Pa. Then the infiltration atmosphere was decided to be 1×10^{2}Pa introducing a continuous flow of argon.

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