

MATERIALS AND STRUCTURES SYMPOSIUM (C2)  
Advanced Materials and Structures for High Temperature Applications (4)

Author: Prof.Dr. Ai Bangcheng  
China Academy of Aerospace Aerodynamics (CAAA), China, stara@sohu.com

Mr. Chen Siyuan  
China Academy of Aerospace Aerodynamics (CAAA), China, siyuanbuaa@163.com

Dr. Li Pengfei  
China Academy of Aerospace Aerodynamics (CAAA), China, nifei040505@163.com

Dr. Chen Zhi  
China Academy of Aerospace Aerodynamics (CAAA), China, lvjia2609@163.com

Dr. Hu Longfei  
China Academy of Aerospace Aerodynamics (CAAA), China, longfeihu@163.com

A NEW TYPE SCRAMJET THERMAL PROTECTION STRUCTURE BASED ON HIGH  
TEMPERATURE HEAT PIPE TECHNIQUE

**Abstract**

Thermal protection system is one of the biggest challenge for scramjets. Definitely, design of thermal protection structure is a key technique. This paper develops a new type scramjet thermal protection structure based on advanced thermal management. The wall of scramjets is composed of high temperature heat pipes with integral flat plate. The well designed heat pipes have excellent heat transfer ability to reduce the local high temperature point and make the wall isothermal. Furthermore, some fuel cooling pipes are embedded in the flat plate heat pipe and heat can be exchanged between the fuel pipes and the working stream or fluid in heat pipe. This new type structure realized the combination of active and semi-passive thermal protection technique. The performance of the new type structure was analyzed by numerical simulation. The structure parameters such as wall thickness of heat pipe, diameter and distance between fuel pipes are also optimized. Then, a typical structure is prepared and tested based on arc-jet tunnel facility. The results indicate that the combined performance of new structure is actively improved. As a new concept of thermal protection for scramjets, the processing of structures and cooling efficiency is obviously superior to traditional one.