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RESEARCH ON ULTRAPOROUS COMPOSITE MATERIALS WITH AEROSPACE APPLICATION

Abstract

Nowadays, with the growing interest in interplanetary manned space flight the questions on efficient and reliable thermal protection of spacecraft become primary. On the one hand, spacecraft thermal protections should have the desired strength characteristics and thermal properties, on the other, have a minimum weight to increase the mass of the payload. From this point of view, the most promising materials for these applications are ultraporous composite materials made from superfine fibers of SiO_2, Al_2O_3, TaO_2, ZrO_2, MgO and others. Due to their properties the modern composite materials based on carbon foam (Reticulated Vitreous Carbon) are promising materials with a wide range of applications in different technical areas. In particular, for objects of space engineering those materials could be used as a structural, insulating and shielding materials to create working under extreme conditions design structure. Such materials have a good combination of the following main positive characteristics: high porosity and low density; the relatively high strength; high temperature and heat resistance; good thermal insulation properties in a wide temperature range. It should be noted that the properties of these materials are largely dependent on their structure, production technology and used modifiers, that improve initial properties or provide desired properties. All this allows to create RVC-based composite materials and structures for various purposes with specified properties. This work is devoted to the study of the properties of this class of materials. An adequate mathematical model describing the processes of radiation-conductive heat transfer in the sample of such materials was developed and confirmed by experimental studies. The impact of the thermocouples methodological error on the experimental investigation output data of the material under high vacuum and extreme transient thermal effects was evaluated.