RADIATIVE TRANSFER IN VACUUM THERMAL INSULATION OF SPACE VEHICLES

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ABSTRACT. An improved radiative transfer model for vacuum thermal insulations of space vehicles is developed. The effects of both the fibrous spacer between metal foils and thin oxide layer on the foil surface are taken into account in calculations of integral radiative flux through the insulation. Parametric calculations at realistic values of the problem parameters indicate that absorption and scattering of thermal radiation by fibers do not lead to a significant decrease in the radiative flux. At the same time, even very thin oxide film on surfaces of the aluminum foils should be taken into account in engineering calculations. Theoretical estimates show that even not very dense spacer made of metalized glass fibers with aluminum coating of thickness about 50 nm may lead to almost two-fold decrease in the integral radiative flux.