Modeling heat transfer processes in fractal media at high temperatures

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We have formulated and analytically solved the problem of heat and mass transfer in composite materials with a fractal structure at high temperatures, when a time-varying heat flux is set to one of the boundaries. To find a solution, the problem is reduced to a boundary value problem with boundary conditions of the first kind. The solution to the problem was found using the Fourier transform in the spatial variable and the Laplace transform in time. When modeling various processes in fractal medias, fractional powers in terms of dimensions often arise. In a fractal medium, in contrast to an ordinary continuous medium, a randomly wandering particle moves away from the reference point more slowly, since not all directions of motion become available to it. The deceleration of the diffusion process in fractal media is so significant that physical quantities begin to change more slowly than in ordinary media, and this effect can be taken into account only with the help of integral differential equations containing a fractional time derivative. The development of mathematical models and computational algorithms demanded the problems of modeling non-local processes and phenomena in fractal environments. These include the processes of heat and mass transfer in media with a fractal structure and memory, anomalous transfer of particles with a finite speed of free motion. This work is devoted to the study of the temperature field of composite materials with a fractal structure at high temperatures, when a heat flux is set at one of the boundaries. The work was made as a part of the state task of the Ministry of Science and Higher Education of Russia with a partial support of the RFBR Grant 20-08-00319a.