TRANSIENT COOLING OF A CYLINDRICAL GLASS GOB

Raymond Viskanta and Jongmook Lim
School of Mechanical Engineering
Purdue University, West Lafayette, IN 47907-1288, USA

ABSTRACT. Transient cooling of a hot glass gob by internal combined conduction and radiation is analyzed. The spectral dependence of the absorption coefficient on wavelength and temperature is appropriately accounted for by solving the radiative transfer equation for the axisymmetric cylindrical geometry. Specularly reflecting boundaries are considered and Fresnel's equations are used to predict the spectral directional reflection and transmission characteristics of the interfaces. The finite volume method is used to solve numerically the thermal energy equation, and discrete ordinates method (DOM, S-N method) is employed to solve the radiative transfer equation (RTE). Dynamic cooling calculations have been performed and transient temperature distributions, temperature gradients, convective and combined convective plus radiation results are presented and discussed. The results show that for the initial and thermal conditions of interest, the interior of the glass cools primarily by radiation and only the surface layers ($0.8 < r/R < 1.0$) is conduction of the same order of magnitude as radiation.