A MODIFIED DIFFERENTIAL APPROXIMATION FOR THERMAL RADIATION OF SEMITRANSPARENT NONISOTHERMAL PARTICLES: APPLICATION TO OPTICAL DIAGNOSTICS OF PLASMA SPRAYING

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ABSTRACT. A modified differential approximation proposed recently by the author is formulated for nonisothermal particles. This approximation called MDP_0 (modified DP_0) is much simpler than the radiation transfer equation (RTE). Comparison with the RTE solution confirms an acceptable accuracy of MDP_0. An improved model of particle heating in plasma spraying is proposed. This model, which includes MDP_0 equations, takes into account the radiation-conduction interaction inside the particle. Calculations for metal oxide particles in a typical plasma jet show that the particle color temperature, which is usually determined in monitoring the plasma spraying, is very sensitive to the absorption index of the particle substance. This effect should be taken into account in experimental evaluations of the bulk temperature of particles.