Belolipetskii, A. A.; **Malinina, E. A.**; **Semenov, K. O.**

Mathematical model of fuel layer degradation when the laser target is heated by thermal radiation in the reactor working chamber. (English. Russian original) Zbl 1200.80007

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The authors consider a multilayer polystyrene spherical shell which is filled in with solid hydrogen isotopes (deuterium and tritium). This is called a laser target. The paper intends to model the deformations of the laser target under the action of a laser beam. The authors write the heat equations in the sphere and in the fuel layer which include a corrector coefficient linked to the deformations of the sphere. They finally write the Navier-Stokes equation for the momentum transport in a viscous gas (the heart of the sphere) and the energy transport in this gas. Transmission conditions and boundary conditions are added to this set of parabolic equations. The authors then introduce some simplifications and dimensionless variables which contain a small parameter δ in the space variables. These simplifications lead to a singularly perturbed Stefan problem for a parabolic equation which describes the evolutions of temperature T_s of the fuel layer. They introduce an asymptotic expansion of T_s in powers of δ. They compute the first-order terms of this asymptotic expansion. The paper ends with the computation of the fuel layer degradation time taking realistic data.

Reviewer: Alain Brillard (Riedisheim)

MSC:

80A22 Stefan problems, phase changes, etc.
80A32 Chemically reacting flows

Keywords:

multilayer polystyrene spherical shell; laser target; laser beam; hydrogen isotopes; Stefan problem; asymptotic expansion; fuel layer degradation time

Software:

ECOMOD

Full Text: DOI

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