ABSTRACT

The present study is subdivided into two parts ; The first part deals with the study of the effect of the laser pulse shape and multipulses on the development of the temporal and spatial temperature distribution in a semi-infinite target and a thin film coated on a semi-infinite substrate .

The second part is devoted to solve the problem of melting a thin film coated on a semi-infinite substrate subjected to a given laser pulse profile. In both parts it is assumed that the absorption coefficient of the cooled irradiated surface of the target is temperature dependent. The obtained results from the first part show , for an *Al*-semi-infinite target and an *Al*-thin film coated on a semi-infinite glass substrate , that the dependence of the surface absorption coefficient on the temperature changes the temporal and spatial temperature distribution markedly , while the cooling plays a minor role and can be neglected. The results also show that , for all laser temporal pulse profiles except the square pulse , the surface temperature exhibits a maximum. These maxima occur at different times after reaching the laser pulse profile its maximum value. The penetration depth of the temperature determined at the end of the laser pulse is found to be a function of the laser pulse duration and is practically independent of its temporal profile.

In the second part of the study , the pulse duration of the laser is subdivided into three parts :1) The first deals with the heating process up to the melting point of the target. 2) The second part induces melting with a constant temperature distribution in the molten layer and lasts up to the time at which the film is completely molten. 3)The third part of the pulse is responsible for heating the configuration up to the point of evaporation of the liquidified film. For an *Al*-layer coated on a semi-infinite glass substrate and subjected to a given laser pulse profile, the computations show that , the time of melting , full liquidification and that at which the evaporation occurs, increases as the surface absorption becomes temperature independent and cooling is considered. Also in this part it is found that the effect of the dependence of the surface absorption coefficient on temperature is greater than that of cooling. The thermal penetration depth measured from the front surface of the configuration up to the point at which the temperature reaches *1/100* from the front surface temperature is practically independent of the absorption coefficient.