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A New Synthetical Model of High-Power Pulsed Laser Ablation

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Abstract: We develop a new synthetical model of high-power pulsed laser ablation, which considers the dynamic absorptance, vaporization, and plasma shielding. And the corresponding heat conduction equations with the initial and boundary conditions are given. The numerical solutions are obtained under the reasonable technical parameter conditions by taking $YBa_2Cu_3O_7$ target for example. The space-dependence and time-dependence of temperature in target at a certain laser fluence are presented, then, the transmitted intensity through plasma plume, space-dependence of temperature and ablation rate for different laser fluences are significantly analyzed. As a result, the satisfactorily good agreement between our numerical results and experimental results indicates that the influences of the dynamic absorptance, vaporization, and plasma shielding cannot be neglected. Taking all the three mechanisms above simultaneously into account for the first time, we cause the present model to be more practical.

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Key words: pulsed laser ablation, dynamic absorptance, vaporization, laser produced plasma

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