the above characteristics of these films by application of analytical formulas was to the interference extrema. (Swanepoel method). It has been found that the thickness of films decrease by increasing the photon energy of laser and its energy density. It has been observed that the transmittance decreases with the increase of film thickness. From transmittance data, the dispersion of refractive index of sample has been studied. It was found that at high energy density (50.35 J/cm^2), the refractive index of sample was more increased. The highest increased in refractive index ($\Delta n \approx 0.1$) was found for sample which irradiated by 532nm laser beam with 50.35 J/cm^2 energy density.

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Electron self-injection and acceleration in the bubble regime of laser-plasma interaction

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The intense laser-plasma and beam-plasma interactions are highly nonlinear phenomena, which besides being of fundamental interest, attract a great attention due to a number of important applications. One of the key applications is particle acceleration based on excitation of the strong plasma wakefield by laser pulse [1]. In the linear regime of interaction when the laser intensity is low the plasma wake is the linear plasma wave. Moreover, the ponderomotive force of the laser pulse pushes out the plasma electrons from high intensity region leaving behind the laser pulse the plasma cavity - bubble, which is almost free from the plasma electrons. This is the bubble regime of the laser-plasma interaction [2].

Although the bubble propagates with velocity, which is close to speed of light, the huge charge of unshielded ions inside the plasma cavity can trap the cold plasma electrons. Moreover, the electrons are trapped in the accelerated phase of the bubble plasma field thereby leading to efficient electron acceleration. The electron self-injection is an important advantage of the plasma-based acceleration, which allows to exclude the beam loading system requiring accurate synchronization and additional space. The recent experiments have demonstrated high efficiency of the electron self-injection. The beam quality is often of crucial importance in many applications ranging from inertial confinement fusion to the x-ray free electron lasers.

Despite a great interest there is still a little theory for relativistic electron dynamics in the plasma wake in multidimensional geometry including electron self-injection. The dynamics of the self-injected electrons can be roughly divided into three stage: (i) electron scattering by the laser pulse [3], (ii) electron trapping by the bubble [4], (iii) electron acceleration in the bubble. We developed two analytical models for electron dynamics in the bubble field and verify them by direct measurements of model parameters in 3D particle-in-cell (PIC) simulations. The first model is based on a piecewise approximation of the bubble field [5] while the second one uses more realistic distribution of the electromagnetic field inside the bubble. The simulation results are in a good agreement with the model predictions.

Acknowledgments

This work has been supported by federal target program "The scientific and scientific-pedagogical personnel of innovation in Russia" and by the Russian Foundation for Basic Research.

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