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Dynamics of ultrafast laser processing of materials

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Transient free electron plasma is created during the leading edge of an intense ultrafast laser pulse irradiation of a material. Subsequent interaction of this plasma with the rest of the incident light is often ignored in laser processing of materials. We will show that light-plasma interaction plays an important role resulting in polarization dependent features both on the surface and inside the bulk. Local field enhancement leads to asymmetric electron density distribution that is either parallel or perpendicular to the laser polarization depending on the transient plasma density. We demonstrate polarization effects in ablation of silicon and polymethylmethacrylate, and in refractive index modification of silica glass.

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