FROZEN NANOSTRUCTURES PRODUCED BY ULTRASHORT LASER PULSE

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A thin surface layer with high temperature and pressure can be produced by almost isochoric heating with a short enough laser pulse. The stretched molten material is formed during melting and hydrodynamical expansion of this layer. Bubble nucleation and cavitation are initiated if a sufficiently high tensile stress is generated in the melt. Expansion of the bubble ensemble leads to formation of low-dense foam-like material at later times. However, remarkable elasticity of the foam is retained during long time, leading to slow down of expansion. Meanwhile, very high temperature gradient results in ultrafast cooling of the melt. For the laser intensity below the ablation threshold the foam expansion stops, then starts to shrink and finally freezes into complex solid nanostructures, which are observed experimentally.[1]

A comparison of experimental results and molecular dynamics simulation[1, 2] is presented.

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