Elastoplastic formation of the laser crater and the rollers around it are completely in the solid state

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In the first works of our team [1, 2], the elastoplastic dynamics of roughness formation on an initially polished flat surface of polycrystalline copper under the action of nanosecond (ns) irradiation was described. Few grains are inside the laser focal spot. The roughness was caused by the inhomogeneous thermal expansion and compression of neighboring crystallites, due to the anisotropy of the coefficients of thermal expansion and creep. Moreover, heating by 100-200 degrees is enough for internal stresses to exceed the threshold of plasticity. Then the results in the form of anisotropic expansion remain in the form of roughness. This paper presents the results of ns heating of a homogeneous layer (not a polycrystal). It is shown that the rollers around the crater are formed in the absence of melting and the Marangoni effect. This is due to the fact that thermal stresses exceed the threshold of plasticity. As a result, the layer is deformed so that a pit (crater) and sides (fringing rollers) are formed in it. Amplitudes of deformations increase with number of ns pulses.

[1] Nelasov I, Manokhin S, Kolobov Y, Zhakhovsky V, Perov E, Petrov Y, Khomich Y, Malinsky T, Inogamov N and Rogalin V 2025 *ZhETF (in Russian)* **167**(6) 782–797

[2] Rogalin V, Zhakhovsky V, Inogamov N, Kolobov Y, Manokhin S, Malinsky T, Nelasov I, Perov E, Petrov Y, Khokhlov V, Khomich Y and Doludenko A 2025 *Physics of the Solid State (FTT - in Russian)* **67**(12)