The effect of nanoparticles on X-ray generation during irradiation of a solid-state target with an MHz femtosecond laser

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Modern fiber-based MHz laser systems, such as the ANTAUS-10W-40u/250K (1030 nm, 280 fs, 2 MHz, 20 W), make it possible to generate bright microfocused laser–plasma X-ray sources for microscopy applications [1]. Such sources offer convenient operation under non-vacuum conditions. However, contamination by ablation products affects the operational stability of a microfocused source. It has been established that, when femtosecond laser pulses at MHz repetition rates and an intensity of 10^{14} W/cm^2 irradiate an iron target, ablation leads to the accumulation of particles with diameters of 4–500 nm in the interaction region. This process results in an exponential decrease in the X-ray output with an attenuation time constant of $t \approx 80$ min.

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