Study of Infrared Femtosecond Laser Processing of Bulk MoS_2

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Two-dimensional (2D) materials possess excellent physical and chemical properties due to their unique atomic arrangement, making them widely used in optoelectronic and energy storage devices. Currently, the patterning of 2D materials primarily relies on specific shapes of chemical vapor deposition and ion beam etching. These methods are complex and costly, and they may introduce defects and surface contamination that can affect device performance. Laser processing technology, known for its flexibility and high precision, has been widely applied in material patterning. Current research on laser processing mainly focuses on achieving monolayer removal of 2D materials through continuous laser scanning in the visible light range; however, experimental and simulation studies on infrared pulsed laser processing of bulk MoS_2 are still limited. This paper employs time-dependent density functional theory (TDDFT) for simulation and, in conjunction with experimental results, analyzes the damage threshold to bulk MoS_2 during near-threshold pulsed laser processing. The research findings provide guidance for the precise patterning of 2D materials using laser processing.