Laser-Induced Growth of Metal Oxide Crystals for Memristor Applications

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Laser-induced crystallization offers a direct, energy-efficient, and scalable method for synthesizing high-quality metal oxide crystals tailored for memristor applications [1]. By focusing a laser beam on precursor films or powders, localized and rapid heating facilitates the formation of crystalline domains through controlled oxidation and phase transitions [2]. This method enables the site-specific growth of functional oxides such as MoO_3, WO_3, and V_2O_5, ideal for integration into next-generation resistive memory devices [3]. The sharp temperature gradients and fast cooling rates provided by laser irradiation enhance crystal quality and orientation, crucial for achieving repeatable switching behaviour in memristors [4]. Crystalline α-MoO_3 belts grown on insulating substrates exhibited uniform morphology and high crystallinity, as confirmed by XRD and Raman spectroscopy. Electrical testing of planar devices fabricated using these laser-grown crystals revealed stable resistive switching with high ON/OFF ratios and low power consumption [5], attributed to controlled filament formation and redox activity within the oxide structure [6]. This approach eliminates the need for high-temperature furnaces or lithographic patterning, enabling rapid prototyping of memristor arrays on flexible or temperature-sensitive substrates. The direct laser growth technique thus represents a promising platform for the development of cost-effective, high-performance oxide-based neuromorphic computing elements.

References

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Figures

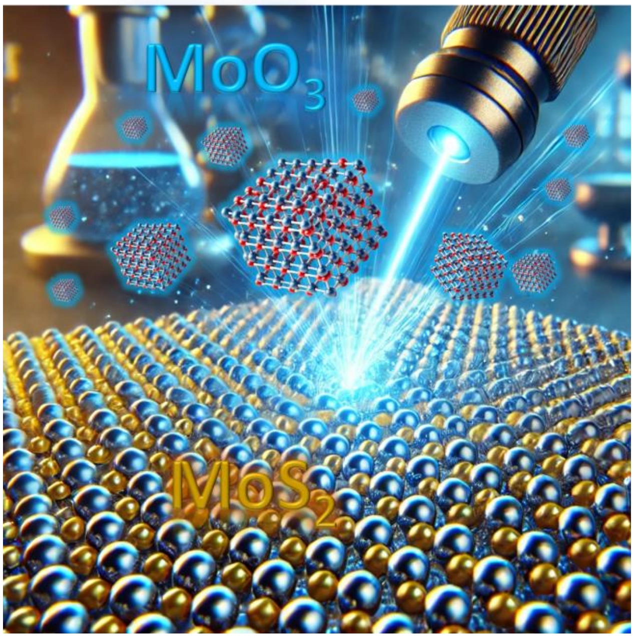

Figure 1. Graphical abstract of the synthesis process of Molybdenum oxide crystals