Structural and Stoichiometry Quantification of Ho_2O_3 Thin Film grown using Pulsed Laser Deposition

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Pulsed laser deposition (PLD) is widely recognized for enabling the stoichiometric growth of high-quality thin films [1]. In this study, we employed PLD to grow Ho_2O_3 thin films using KrF (λ = 248 nm) and Nd:YAG (λ = 532 nm) lasers. Ho_2O_3 has been identified as a promising material for realizing an X-ray laser on a chip [2]. Here, we focus on optimizing the growth of Ho_2O_3 thin films on yttria-stabilized zirconia (YSZ) substrates for the first time. The crystalline quality of the films was characterized using X-ray diffraction (XRD), which confirmed unidirectional growth. Reciprocal space mapping (RSM) was utilized to determine the in-plane and out-of-plane lattice parameters, both measured to be 10.61 Å, in agreement with the theoretical value. Furthermore, RSM analysis confirmed the absence of any lattice tilt in the grown crystal.

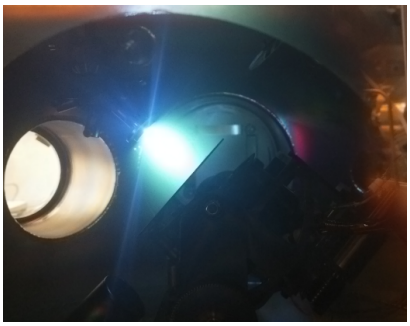

Fig. 1 Ho_2O_3 plume formation via ablation using a KrF excimer laser pulse for thin film deposition.

Stoichiometry analysis was performed using O^{16} resonance Rutherford backscattering spectroscopy (RBS) and confirms the stoichiometry growth of thin film.

[1] Shepelin, Nick A., Zahra P. Tehrani, Natacha Ohannessian, Christof W. Schneider, Daniele Pergolesi, and Thomas Lippert. Chemical Society Reviews 52, **2023**, 7, 2294-2321.

[2] Rameshbabu, Sharath, and Davide Bleiner. In *Compact Radiation Sources from EUV to Gamma-rays: Development and Applications*, SPIE, **2023**, 12582, 95-103.