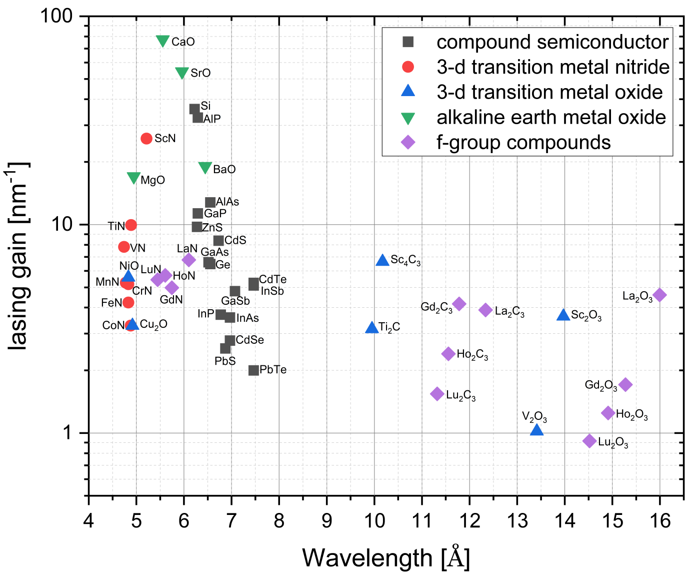
Pulsed laser deposition of Ho_2O_3 Röntgen Thin Films

S. Rameshbabu[1,2], D. Bleiner[1,2]

[1]Swiss Federal Laboratories for Materials Science and Technology (Empa), Überlandstrasse 129, 8600 Dübendorf, [2]University of Zürich, Winterthurerstrasse 190, 8057 Zürich

In 1974, Fisher [1] proposed the concept of utilizing single crystals for an ultra-small X-ray laser. He has proposed several crystals utilizing O-K_a as a resonant wavelength. Ho_2O_3 is one among them. Yariv [2] calculated the lasing parameters in the single crystals to achieve distributed feedback. The main working principle of this X-ray laser relies on resonant matching between the wavelength and the interplanar distance in the crystal. That theoretical foundation never come to an experimental system, mainly due to the strict requirements of crystal quality and stoichiometry.

The main goal of this work is to experimentally realize such compact X-ray laser using single crystals as a suitable "Röntgen material". Detailed calculation on various ''Röntgen materials'' have been performed to evaluate the performance of various materials [3]. From those materials which was illustrated in Fig.1, one of the potential candidate was selected for this experimental work, namely Ho_2O_3. The calculated results provided the dimension for the single crystal, which turns to be around 100 nm. To create such a tiny crystals, we employed pulsed lased deposition (PLD) to grow epitaxial thin film. PLD is well known for its stoichiometry transfer and epitaxial growth of thin film [4]. This is most important in our case. Ho_2O_3 is an interesting candidate to grow as a thin film due to its chemically stability.



1. Fisher, Robert A. *Applied Physics Letters* 24, **1974**, 12, 598-599.
2. Yariv, Amnon. *Applied Physics Letters* 25, **1974**, 2, 105-107.
3. Sharath Rameshbabu, Davide Bleiner. SPIE Optics and Optoelectronics **2023**, 2, 12582-42 (In-press).
4. Shepelin, Nick A., Zahra P. Tehrani, Natacha Ohannessian, Christof W. Schneider, Daniele Pergolesi, and Thomas Lippert. *Chemical Society Reviews*, **2023**.