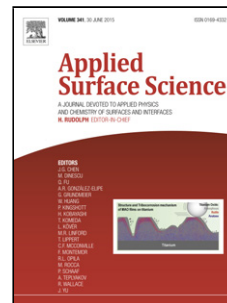


## Accepted Manuscript

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## Pulsed laser deposited $\text{Be}_x\text{Zn}_{1-x}\text{O}_{1-y}\text{S}_y$ quaternary alloy films: structure, composition, and band gap bowing

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### Highlights:

- We grew quaternary BeZnOS films by PLD with self-made  $\text{Be}_{0.06}\text{Zn}_{0.94}\text{O}_{0.27}\text{S}_{0.73}$  target and  $\text{O}_2$ .
- Single-phase BeZnOS films were grown successfully on *c*-sapphire for the first time.
- Lattice parameter *c* and  $E_g$  of single-phase BeZnOS alloys were determined.
- The optical bandgap shows a bowing behavior, and can be adjusted between 3.55 and 3.10 eV.
- BeZnOS exhibits enhanced solid solubility of S ( $y \leq 0.17$  or  $y \geq 0.35$ ) compared to ZnOS.

### Abstract

In this work, *c*-axis preferentially oriented  $\text{Be}_x\text{Zn}_{1-x}\text{O}_{1-y}\text{S}_y$  (BeZnOS) quaternary alloy films were prepared successfully on *c*-plane sapphire by pulsed laser deposition for the first time. By appropriate adjustment of  $\text{O}_2$  pressure during the deposition, the grown films exhibited a single-phase hexagonal structure and good crystalline quality. The solid solubility of S in  $\text{Be}_x\text{Zn}_{1-x}\text{O}_{1-y}\text{S}_y$  quaternary alloy was significantly expanded ( $y \leq 0.17$  or  $y \geq 0.35$ ) as a result of simultaneous substitution of cation  $\text{Zn}^{2+}$  by smaller

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