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Supplementary Materials

ZnO Nanowires on Single-Crystalline Aluminum Film Coupled with an Insulating WO_3 Interlayer Manifesting Low Threshold SPP Laser Operation

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1. Schematic representation of a ZnO nanowire placed on a WO_3 dielectric layer coated Al film

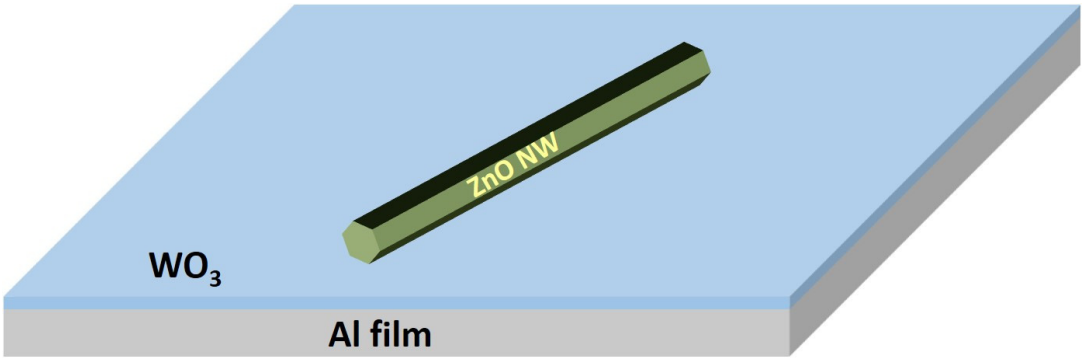

Figure 1. Schematic representation of a ZnO nanowire placed on a dielectric layer coated Al film.

2. Growth process setup for synthesis of crystalline ZnO nanowires

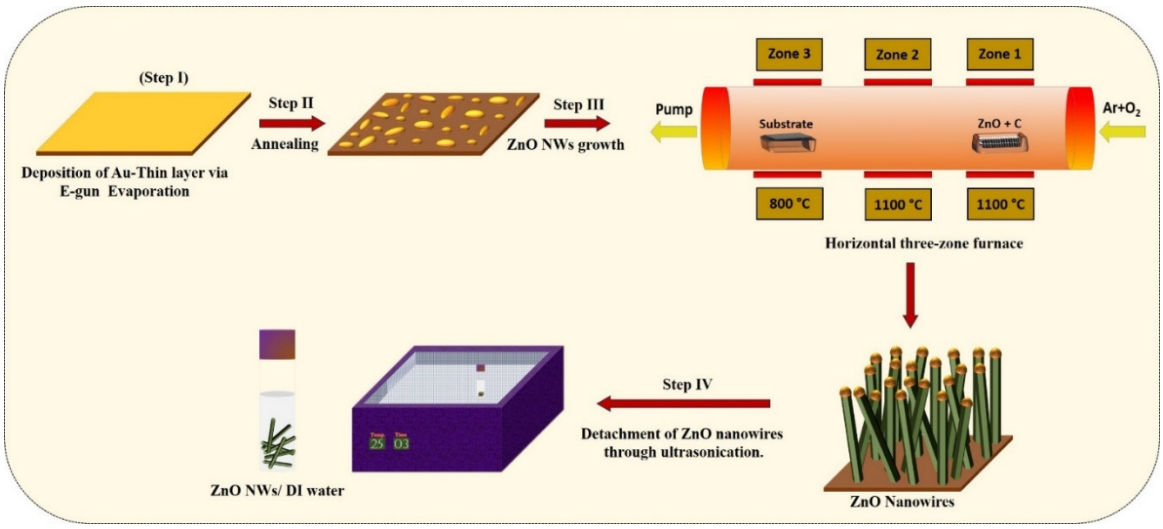

Figure 2. Growth process setup for synthesis of crystalline ZnO nanowires.

3. Setup for photoluminescence and lasing characterizations with a μ-PL system

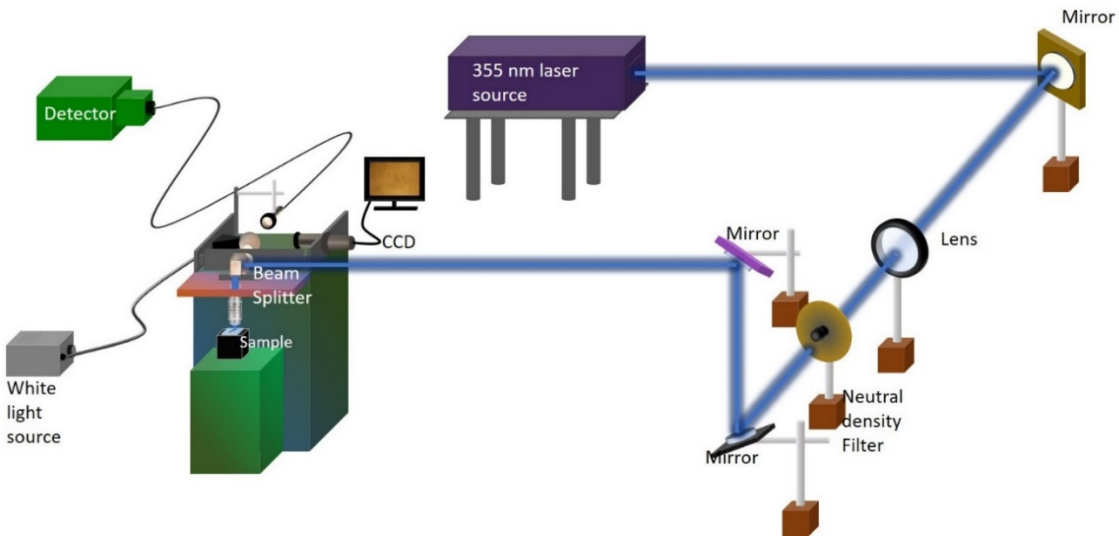

Figure 3. Setup for photoluminescence and lasing characterizations with a μ-PL system.

4. Survey spectra obtained by X-ray photoelectron spectroscopy for WO_3 oxide layer

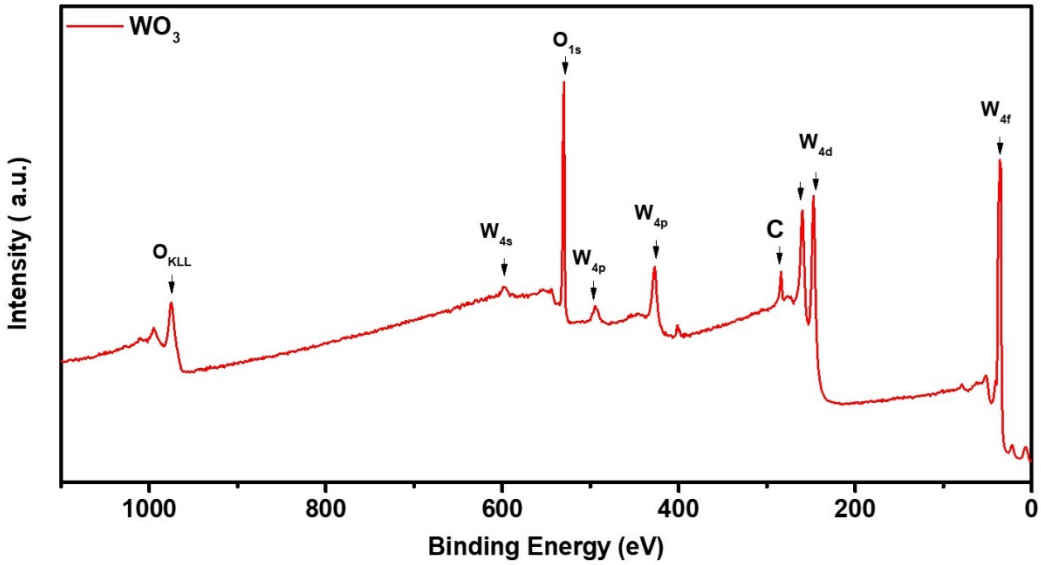

Figure 4. Survey spectra obtained by X-ray photoelectron spectroscopy for WO_3 oxide layer.

5. Dielectric constants obtained by spectroscopic ellipsometry in the wavelength range of 300-1400 nm for different thicknesses of WO_3 oxide layer

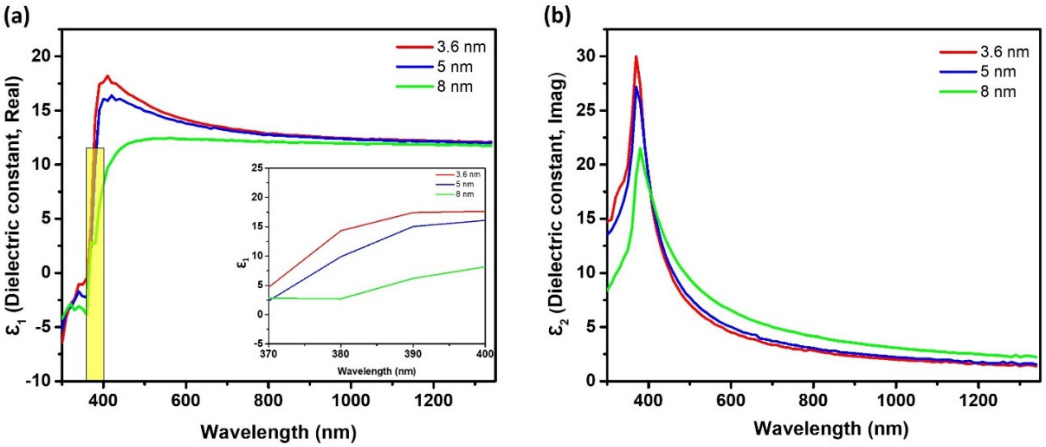

Figure 5. Dielectric constants obtained by spectroscopic ellipsometry in the wavelength range of 300-1400 nm for different thicknesses of WO_3 oxide layer.

6. The simulated effective index for ZnO plasmonic nanolasers from 370–410 nm for different thicknesses of WO_3 layer, obtained from FDTD mode solution method

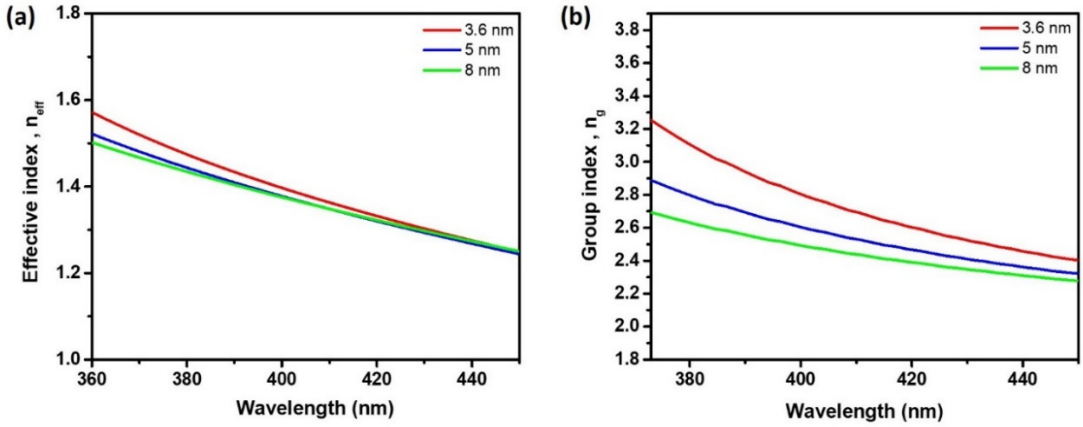

Figure 6. The Simulated (a) effective index and (b) group index for ZnO plasmonic nanolasers from 370-410 nm for different thicknesses of WO_3 layer, obtained from FDTD mode solution method.

7. The AFM profiles of WO_3 layers of different thicknesses

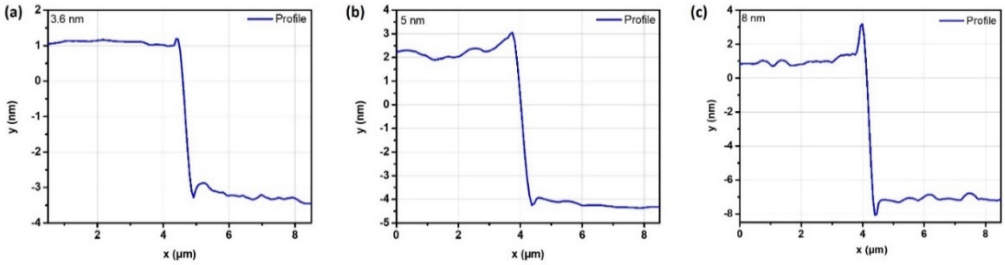

Figure 7. The AFM profiles of WO_3 layers with the thicknesses of **(a)** 3.6 nm, **(b)** 5 nm, and **(c)** 8 nm.

Table 1. Comparison of plasmonic nanowire lasing thresholds with different dielectric thicknesses.

Year	Gain Medium	Metal - Dielectric	Dielectric Thickness	Pump	Temperature	Threshold	References
2020	ZnO	Al-WO_3	3.6 nm 5.0 nm 8.0 nm	Optical, pulsed	RT[1]	0.79 MW cm^{-2} 1.88 MW cm^{-2} 2.43 MW cm^{-2}	Current study
2019	ZnO	Al-ALD-Al_2O_3	5 nm 10 nm 15 nm	Optical, pulsed	RT	6.27 MW cm^{-2} 11.1 MW cm^{-2} 18.2 MW cm^{-2}	[1]
2016	ZnO	Al-Al_2O_3	5 nm	Optical, pulsed	RT	≈ 100 MW cm^{-2}	[2]
2015	GaAs-AlGaAs	Ag-Non	-	Optical, pulsed	8 K	≈ 1 kW cm^{-2}	[3]
2014	GaN	Al-SiO_2	5 nm	Optical, pulsed	RT	≈ 3.5 MW cm^{-2}	[4]

2012	InGaN	Ag-SiO_2	5 nm	Optical, continuous	78 K	≈ 3.7 kW cm^{-2}	[5]
2009	CdS	Ag-MgF_2	5 nm	Optical, pulsed	10 K	≈ 100 MW cm^{-2}	[6]

[1] RT, Room temperature

References

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