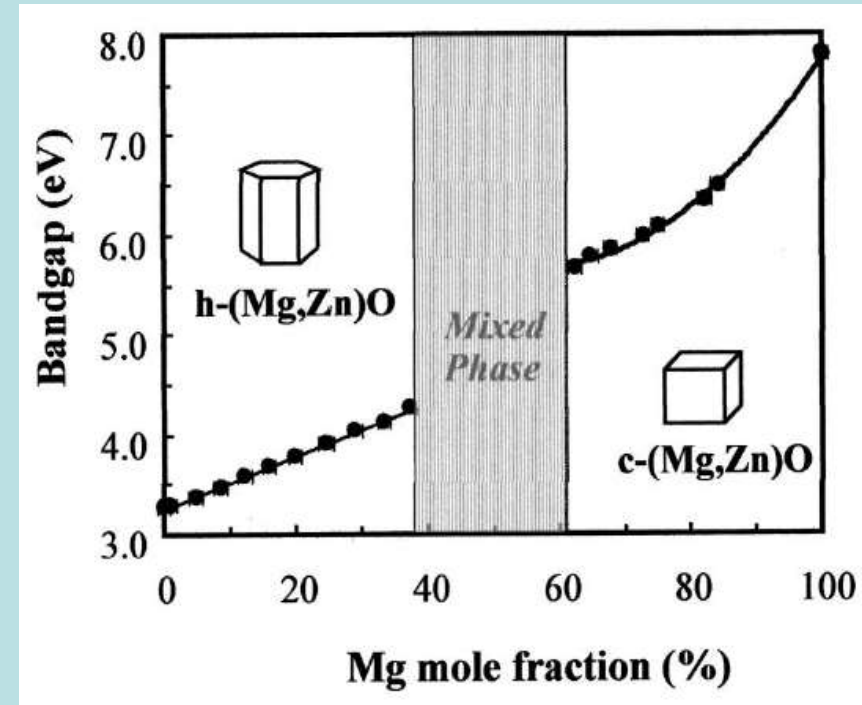
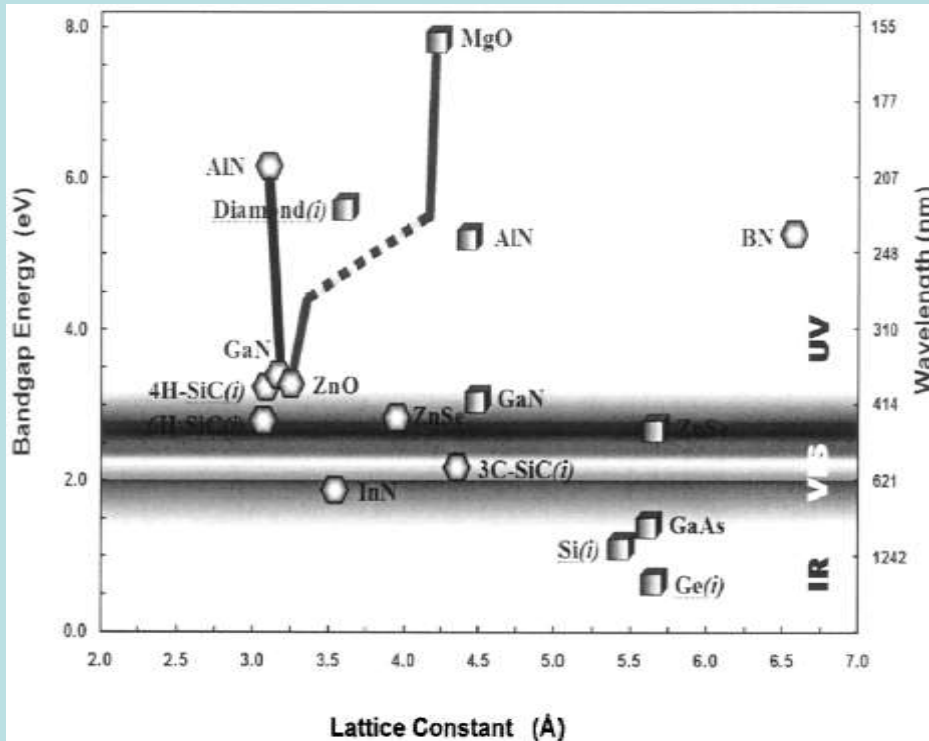


## *ZnMgO based UV detectors for various application*

Veaceslav URSAKI

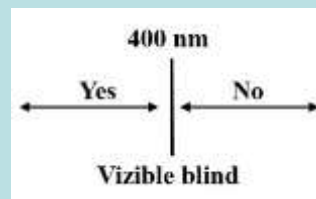
Academy of Science of Moldova  
Institute of Electronic Engineering and Nanotechnology "D. Ghitu"  
vvursaki@gmail.com

## Wide bandgap materials for applications related to ultraviolet (UV) radiation

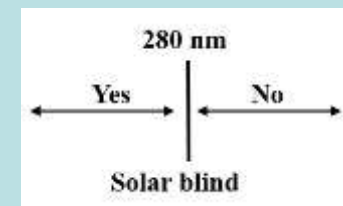


Ultraviolet (UV) radiation constitutes a portion of the electromagnetic spectrum from 100 to 400 nm, and is further subdivided into three wavelength ranges:

- UV-A (315 to 400 nm),
- UV-B (280 to 315 nm),
- UV-C (100 to 280 nm).



**Detectors**



## **Civil applications:**

flame sensing,  
lamp control in UV sterilization and curing-dose regulation,  
personal tanning monitors,  
analytical instruments,  
welding-goggle automatic dimming controls, etc.

## **Military applications:**

Registration of extremely hot missile exhaust plumes at wavelengths below 280 nm. Because there is no natural solar illumination to produce background clutter to obscure the hot target, a UV imager could see a missile unambiguously.

Multispectral imaging can extract significantly more information about its surroundings than regular sensors. Multispectral imaging can be used for tasks such as locating explosives, uncovering enemy movements and pinpointing the depth of hidden bunkers.

The availability of real-time UV imaging sensors has made near-ultraviolet camouflage a field necessity for both personnel and strategic military equipment.

# Military Recognition of the Ultraviolet Sensor Threat

| DIFFUSE REFLECTION OF NEAR-ULTRAVIOLET FROM SURFACES *   |                                    |
|--|------------------------------------|
| Surface  | Percent Diffuse Reflection @ 370nm |
| Fresh snow - 5cm   | 80                                 |
| Fresh snow - 2cm   | 67                                 |
| "Dirty" old snow   | 50                                 |
| Dry dune sand  | 22                                 |
| Dry sand - Baltic  | 21                                 |
| Dry white dune sand                                      | 39                                 |
| Atlantic beach sand - wet                                | 9                                  |
| Sea foam (surf)  | 39                                 |
| Cultivated fields - stubble, beets, grass, oats, and rye | 2                                  |
| Green lawn   | 3                                  |
| Loam   | 7                                  |
| Green mountain grassland                                 | 2                                  |
| Dry, parched grassland                                   | 4.8                                |
| Sandy turf   | 3.3                                |
| Deciduous trees (leaves)                                 | 3 - 7                              |
| Unpainted wood   | 8.3                                |
| White cement   | 22                                 |
| Concrete pavement - dry                                  | 15.6                               |
| Concrete pavement - wet                                  | 11                                 |
| Black asphalt  | 11.7                               |
| NH Granite boulder                                       | 70                                 |
| Rough dark tree bark (oak)                               | 15                                 |
| Smooth medium tree bark (aspen)                          | 50                                 |
| White birch bark   | 70                                 |
| Water  | 5                                  |

\* Compiled from published studies and author's research, then averaged.

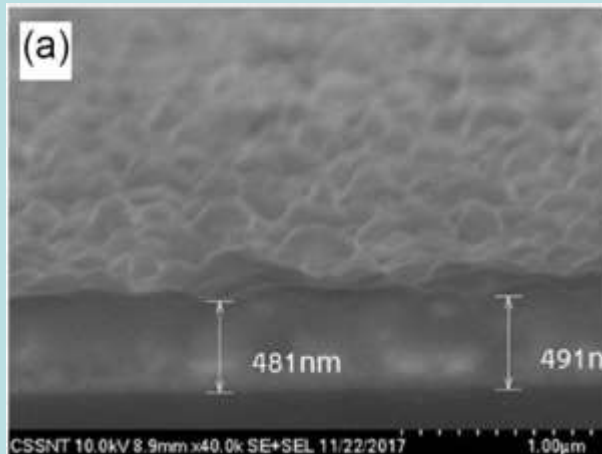
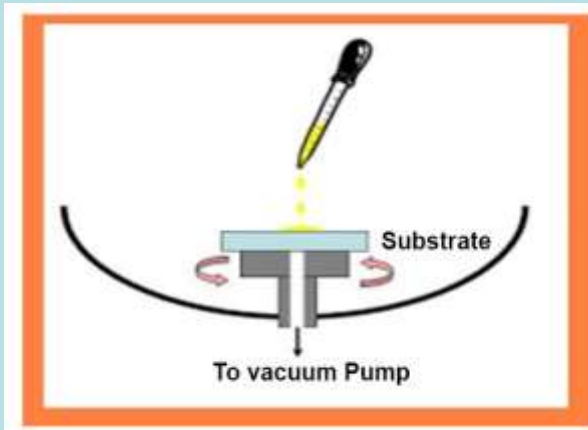


Visible, IR, UV images of uniform with right side treated with UVRC-A 7%

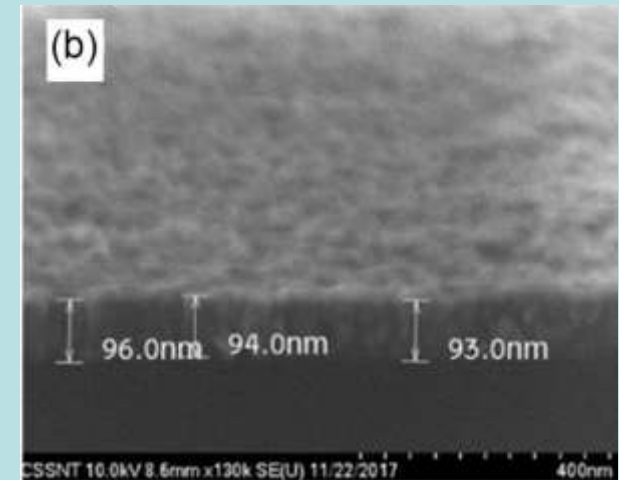
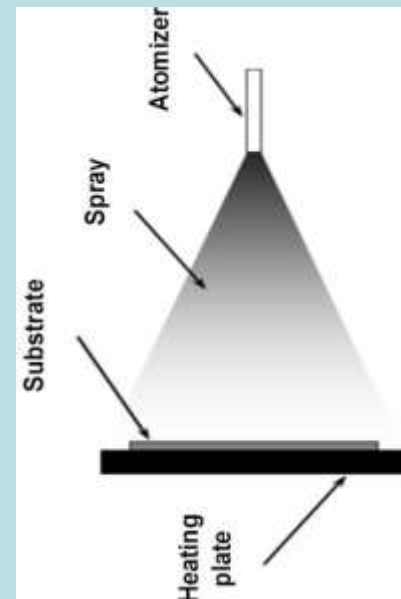
For decades, NATO has mandated a highly ultraviolet-reflective white paint as ultraviolet camouflage for all vehicles used in snow conditions.

## For the preparation of ZnMgO layers

### Spin Coating



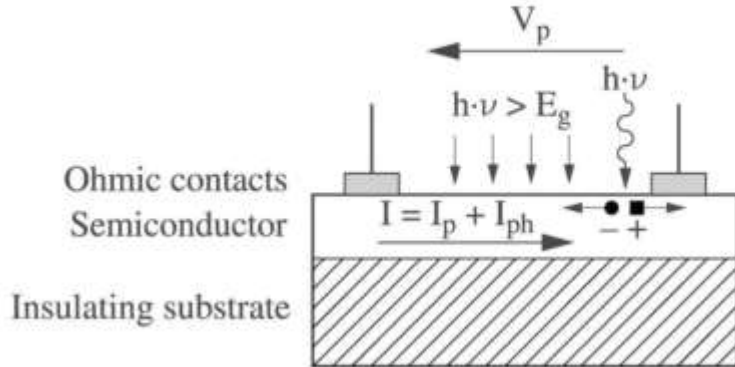
### Aerosol deposition



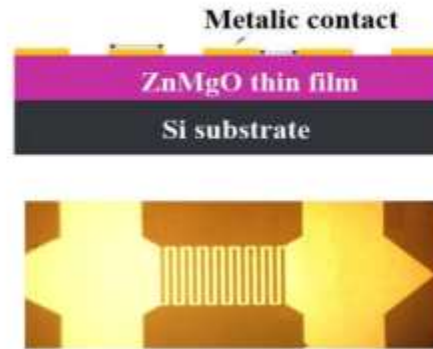
#### Advantages:

- Ensuring easy control and handling of chemicals and substrates, as well as excellent control over stoichiometry.
- Suitable for fabrication of high quality large area thin film at faster rates and low cost due to non vacuum requirement and low temperature processing.
- Offers possibilities for easy doping and preparation of homogeneous films with good electrical and optical properties.

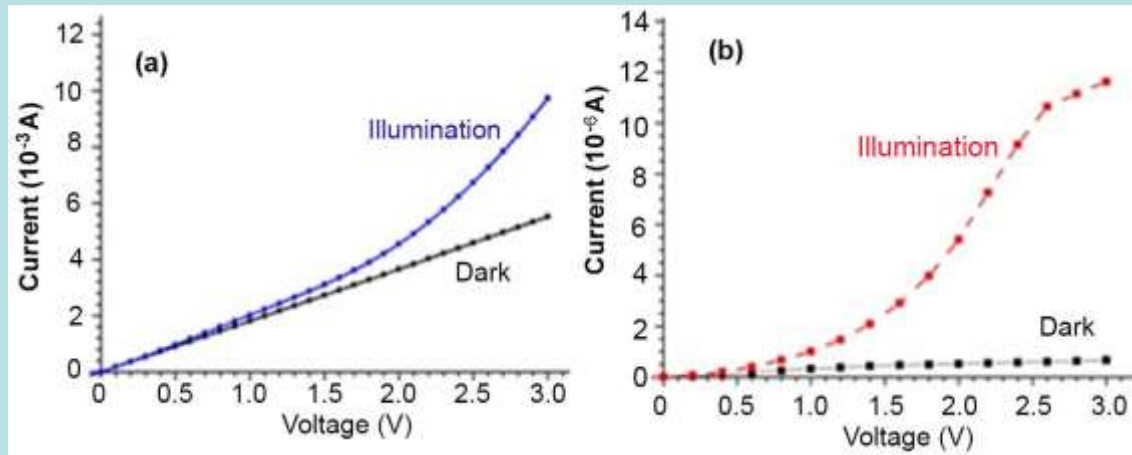
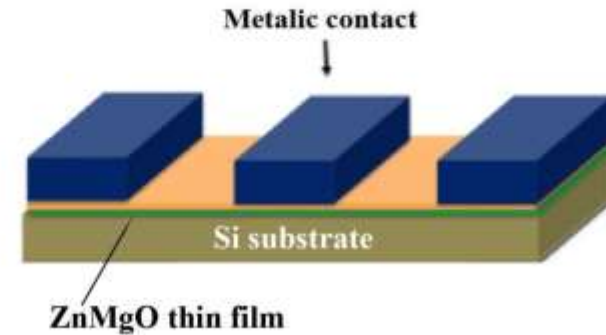
### Photoconductor



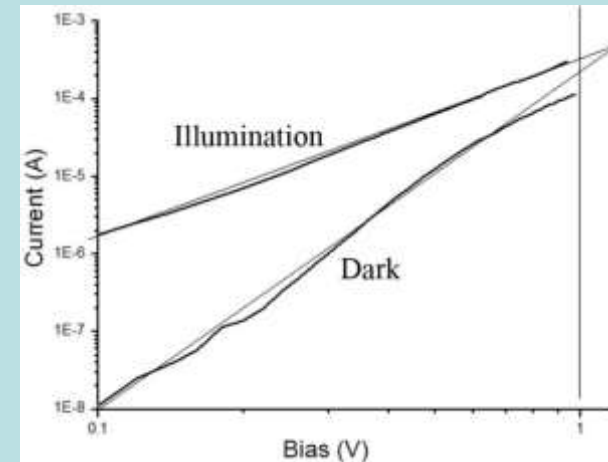
### MSM structure



### Heterostructure



*Current-voltage characteristics in dark and under UV illumination for  $\text{Zn}_{0.8}\text{Mg}_{0.2}\text{O}$  films deposited by aerosol (a) and spin-coating (b) methods*



*Current-voltage characteristics of the heterostructure*

**We have developed cheap and versatile technology for preparing thin single phase wurtzite ZnMgO films with Mg content up to 40% for the development of UV photodetectors. The films with the content of 40% are suitable for the fabrication of solar blind photodetectors.**

**Now we are working with technologies for preparation of cubic phase ZnMgO films with high Mg content, in order to move further in the deep UV spectral range.**

**Thanks for your attention!**