G.F. Neumark, Columbia University & M.C. Tamargo, CC-CUNY

Study Of Doping In ZnBe Chalcogenide Alloys Via MBE Growth With Use Of Non-equilibrium Concepts (DMR-98-05760)

Wide bandgap semiconductors are very important for technological advances that benefit society, including laser diodes, light emitting diodes, UV detectors, and optical data storage, which are used in consumer electronics (DVDs, CDs, solid state lighting), in home-land defense (detection of bio-weapons) as well as military (missile defense, direct sight communication).

Major problems of such materials are bipolar conductivity, device degradation, and/or poor sensitivity

Addition of Be to ZnSe.

Aims: Improve material quality, reduce degradation, increase sensitivity.

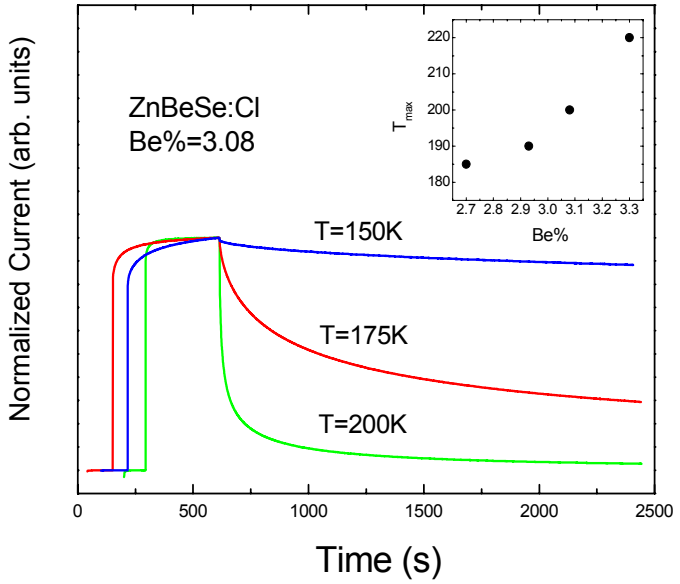
Results: Improved material quality—reduced dislocations. Increased persistent photoconductivity (photocurrent after light is turned off) => optical data storage.

Addition of Te to N-doped ZnBeSe

Aim: Better p-type conductivity

Results: Conductivity increased by an order of magnitude. Higher conductivity thought to be due to nano-islands of N-embedded ZnTe.

	ZnBeSe:N	δ^3-ZnBeSe: (N+Te)
XRD FWHM (aresec)	~30	52
Be content (%)	2.6	2.5
Te content (%)	0	0.5
EPD (cm^{-2})	9.8×10^4	5.2×10^5
N_a-N_d (cm^{-3})	2×10^{17}	1.5×10^{18}



PPC of ZnBeSe:Cl; The time of current persistence depends on temperature; Maximum PPC temperature increase with Be concentration (inset)

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EDUCATION:

At Columbia University, this grant provided full or partial support for:

Three undergraduate students, Ms. Lori Neal (African-American), Ms. Chantal Sudbrack, and Mr. Matthew Kunofsky. Ms. Sudbrack went to Northwestern U. for PhD study, and has won an NSF Doctoral Fellowship for 1999-2003 based on work performed with us.

Two graduate students, Mr. Shahrooz Zahgi and Ms. June Lau.

Two Post-Doctoral Fellows (Dr. C. Tian and Dr. I.L. Kuskovsky).

At City College, this grant has provided partial support for

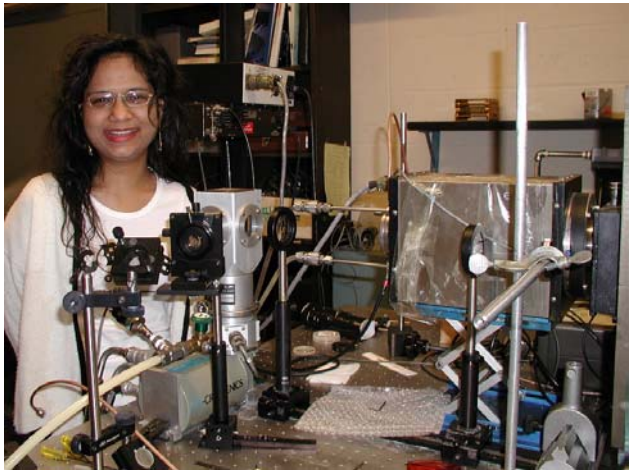
One post-doctoral scholar, Dr. S.P. Guo, and two Ph.D. students, Mr. Oleg Maksimov and Ms. Xuecong Zhou;

Four undergraduate students who performed independent research within the program: Ms. LiHong Liu, Mr. Ben Bamba (African American) and Ms. Maria Corsino (Hispanic).

OUTREACH:

We have had two students from the Bronx High School of Science, who were participating in the Intel Competition and contributed to the project. Mr. Andrew Kim and Ms. Mita Singh, were with us in 2000 and 2002, respectively. Both reached the semi-finals in the Intel Competition, and Mr. Kim was asked to present his work at the New York Science Fair. Andrew and Mita both went on to college.

Mita now is a freshman at Columbia School of Engineering and Applied Science



Mita measures persistent photoconductivity in our Lab