I-6 14:30~15:10

Diamond Anvil High Pressure Cell (DAC)
An Analog Simulator of Crystal Growth Reactor

Janusz E. DMOCHOWSKI*

Grzegorzewskiej Marii 1 m.1, 02-777 Warszawa, POLAND
e-mail : dmojan@interia.pl

In this communication I will show that applying pressure up to 100 kbar to semiconductor, in particular to III-V compound semiconductor GaAs, one can simulate, to some extent, properties of alloy semiconductors, e.g. $Al_xGa_{1-x}As$ for different $0<x<1$. Thus, one can investigate one sample of well known parameters, instead of, say, 100 samples of different compositions, and each of the samples must be separately characterized, and there is no guarantee, that they have desired parameters. In this respect, for the purpose of basic research, applying pressure is much more reliable, and much more precise tool for investigation of basic properties of material under investigation. The results of basic studies upon applying pressure to simple semiconductor, can be further used to predict properties of semiconductor alloys, and after experimental testing used for device design and fabrication.

The technique which became a standard tool in this pressure range is Diamond Anvil Cell (DAC) technique. The contemporary DAC, commercially available, allow for measurements at cryogenic temperatures and in situ change of pressure (in certain pressure range), which allows for precise measurements especially if investigated property undergoes some drastic change in narrow pressure range.

I will present the basic concepts of the technique and demonstrate application of DAC for optical spectroscopy:

Far Infrared (FIR) Magneto-Optical Transmission Spectroscopy using Far Infrared molecular laser (λ=118μ), photoluminescence in visible light spectrum range. I will explain why high intensity light sources (lasers, synchrotron radiation) are recommended for DAC experiments and discuss further developments of DAC technique for basic and applied research.

References:

1. I.L. Spain and D.J. Dunstan J. Phys. E: Sci. Instrum. 22, p. 923 (1989)
2. D.J. Dunstan and I.L. Spain J. Phys. E: Sci. Instrum. 22, p. 913 (1989)
3. A.D. Prins, I.L. Spain and D.J. Dunstan Semicond. Sci. Technol. **4,** p.237 (1989)
4. Dmochowski, J.E., Wasilewski, Z., Stradling, R.A., 1990, Shallow impurities in semiconductors , Ed: G. Davies Mat.Sci.Forum, 65-66,449
5. Dmochowski,J.E., Wang,P.D., Stradling,R.A., 1991 Semic. Sci. Technol., 6, 118.
6. Dmochowski,J.E., Stradling,R.A., Wang,P.D., Holmes,S.N., Li.M., McCombe,B.D., Weinstein B., 1991 Semic. Sci. Technol., 6, 476.
7. Dmochowski,J.E.,Stradling,R.A.,1993, Jap.J.Appl.Phys.,32, Suppl.32-1,227.
8. Dmochowski,J.E.,Stradling,R.A., Dunstan,D.J.,Prins,A.D., Adams,A.R. Singer, K.E., Fujisawa,T., Kukimoto,H.,1994, Mater.Sci.Forum, 143-147, 1075,
9. Dmochowski,J.E., Sadlo, M.A., Jakiela,R.S., Stradling,R.A., Dunstan,D.J., Prins,A.D., Sly,J.L., Singer, K.E., 1995, High Pressure Science and Technology Ed.W. Trzeciakowski, World Scientific, p.621

*Address in Korea:

(KAIST-GSM), 207-43 Cheongnyangni-dong, Dongdauemun-gu, Seoul 130-012, Korea

Tel (82)-(2)-958 3905, Fax (82)-(2)-958 3604, Home: tel. (82)-(2) 958 0873