SEMI*NANO*

SEMINANO

PHYSICS AND TECHNOLOGY OF ELEMENTAL, ALLOY AND COMPOUND SEMICONDUCTOR NANOCRYSTALS: MATERIALS AND DEVICES

SPECIFIC TARGETED RESEARCH PROJECT

PRIORITY NMP

SEMINANO Publishable Final Activity Report

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1. Project Execution

Contract n°	NMP-1-505285	Reporting period:	Whole project duration (3 Years)
Title	**PHYSICS AND TECHNOLOGY OF ELEMENTAL, ALLOY AND COMPOUND SEMICONDUCTOR NANOCRYSTALS : MATERIALS AND DEVICES**		
Project Website	http://newton.physics.metu.edu.tr/smd/seminano/		

Contractors

Contractor no.	Short Name	Contractor name	Country
1	METU	Middle East Technical University (Prof. Dr. Raşit Turan)	Turkey
2	GU	Gothenburg University (Prof. Dr. Magnus Willander)	Sweden
3	BILKENT	Bilkent University (Prof. Dr. Atilla Aydınlı)	Turkey
4	UMINHO	University of Minho (Assoc. Prof. Dr. Maria J. M. Gomez)	Portugal
5	ISC-CNR	Istituto dei Sistemi Complessi del Consiglio Nazionale delle Ricerche. (Dr. Marcofabio Righini)	Italy
6	MTA MFA	Hungarian Academy of Sciences (Prof. Dr. Zsolt J. Horvath)	Hungary
7	UoO	University of Oslo (Prof. Dr. Terje G. Finstad)	Norway
8	IPPLM	Institute of Plasma Physics and Laser Microfusion (Prof. Jerzy Wolowski)	Poland
9	SPRG	Surface Phenomena Researches Group (Dr. Anatoli I. Kovalev)	Russia
10	BGU	Ben-Gurion University (Dr. Yuval Golan)	Israel
11	UNITN	Università degli Studi di Trento (Prof. L. Pavesi)	Italy

1.1 Primary objectives and state of the art :

The primary objective of this project was to develop fundamental knowledge on the production techniques, characterization and methods of applications of **semiconductor nanocrystals** to light emitting devices and floating gate memories. Three main research directions can be identified in the SEMINANO project : First, physics and chemistry of a number of elemental, alloy and compound semiconductor nanocrystal formation and mechanisms of charge tranport and light emission was studied in a systematic way to acquire fundamental knowledge. Second, methods and technology of obtaining new materials with well characterized nanocrystals suitable for use in device work was

developed. Finally, devices such as Metal Oxide Semiconductor (MOS) structures for use in flash memories and light emitting devices (LEDs) has been designed, fabricated and tested with the unique features of nanocrystals. Full cycle starting from material processing to the demonstration of devices was covered. Different materials, production techniques, processing conditions and characterization techniques were employed to reach comprehensive results for the science and technology of semiconductor nanocrystals. As its main objectives are strongly related to the size dependent phenomena in semiconductors and its outcomes has formes the basis for the new production techniques in the modern microelectronic and photonic industry.

The project has been organized as 3 main workpackages which have interconnections and interdependencies. These workpackages are :

WP1: EFFECTS OF HOST MATRIX, PRODUCTION TECHNIQUES AND PROCESSING CONDITIONS ON THE ELECTRICAL AND OPTICAL PROPERTIES OF Si AND Ge NANOCRYSTALS.

WP2: ALLOY AND COMPOUND SEMICONDUCTOR NANOCRYSTALS FOR NEW GENERATION OPTICAL AND ELECTRICAL DEVICES.

WP3: APPLICATION OF SEMICONDUCTOR NANOCRYSTALS TO LIGHT EMITTING DEVICES AND MEMORY DEVICES.

Some details on the workpackage objectives, tasks, and major achievements are given below, and at the web page of the project : (http://newton.physics.metu.edu.tr/smd/seminano/).

In the first period of the project, studies were carried out with elemental semiconductors. The use of different production techniques and/or matrices, and various combinations of them were the subjects of this period. Work on compound semiconductors CdS, CdTe, and CdSe started in this period.

In the second year period, Seminano consortium focused on the effect of post processing such as hydrogenization and oxidation on the optical and electrical properties of elemental semiconductors. Work on compound and alloy semiconductors accelerated during second year. Some device studies were demonstrated in this period.

In the third year of the project, the consortium has focused on some advanced studies on elemental semiconductors, compound semiconductors prepared by different techniques. MOS-LED and flash memory application were demonstrated during this period.

State of the art

Efficient photoluminescence (PL) from low dimensional Si and Ge in the form of porous Si [1], Si and Ge nanocrystals (NCs) [2], Si/insulator multilayers [3], and Si pillars [4] has stimulated the finding a way of using these structures in an electrically driven light emitting devices. The huge development of information technology and requirements of

miniaturization of electronic components has created ever increasing demands for optoelectronic devices to generate, detect, modulate and process optical signals, which is expected eventually, will partly replace electronic signal processing in today's Si technology. Basic motivation of desire to develop efficient Si based light emitter is low cost, operation at room temperature and compatibility with existing CMOS technology. Several bulk-silicon or Si/Ge superlattice based LED configurations have been suggested as red or infrared emitter [5-7]. However, most of the research concentrated on Si nanocrystal metal oxide semiconductor light emitting device (Si-nc MOSLED) structures due to highly efficient PL from these devices [8, 9].

Although, Si-nc MOSLED structures have been tested for almost ten years, electroluminescence (EL) obtained from these devices generally was very weak and broad with respect to obtained PL. Moreover, EL devices both grown on p and n-type Si substrate emit at very high applied voltage values with mostly unstable light emission. The EL spectra are quite wide in the wavelength range of 300-900 nm. It is generally accepted that ultraviolet, blue, green, orange, red EL emissions are related with the luminescent centers in SiO_x matrix or around nanocrystals.

Very recent and future promising results on the emission from Si nanostructures have been reported in the literature. An interesting one was published last year by Walters et. al. in Nature Materials on field effect EL in Si-ncs. According to this study, both EL and PL were observed between 600 and 900 nm range therefore both can be correlated with electron-hole recombination at the core of the nanocrystals. In this study, electrons and holes are injected into the nanocrystals sequentially. The injection mechanism is assumed to be Fowler-Nordheim tunneling across to tunnel oxide. Field effect light emitting devices are expected to be more robust than previous ones due to limiting impact ionization which causes thermalization induced defects [10]. Fundamentals of light emission from Si NCs is being pursued. İn a recent experiment (A) quantum efficiency of 59% was found for NCs emitting at 750 nm at low excitation powers. A power dependent nonradiative decay mechanism seems to limit the observed quantum efficiency at high excitation levels. Waveguide geometries (B) have been employed to study both PL emission and optical gain as well as Si NC and Er ion coupling for light emission at 1.5 um.

Other recent publications can be summarized as follows. EL from Si nanoclusters in oxide was observed in a range of 900-1200 [11]. While, similar efficiency was observed from these devices, the production cost gets significantly lower. Moreover, Si rich SiO_x structures doped with Er ions were prepared [12]. They reported an emissions about 1.54 nm from Er doped structures with high efficiency. Blue-green emission from nanocrystals in oxide LED structures was studied and the emission was attributed to luminescent defect in oxide matrix [13]. V. Ovchinnikov et al. reported boron and phosphor doped Si-nc EL with visible correlation between EL and PL emission where EL emission peak is shifted to low energy side for both B and P doped samples. P doped samples showed narrower and ten times increase in intensity is observed for 0.5 % P doping [14]. This is in agreement with what SEMINANO consortium has obtained with P doping. Finally, there are some articles represented EL both from Si-nc in oxide and from rare earth doped Si-nc.

A fundamentally new development is the use of plasmons to decrease the lifetime of radiative emission in Si NCs. This is achieved through the use of Ag or Au nanoparticles (D) and PL enhancement from Si NCs has been observed. While the exact mechanism of the process is not very clear it is observed that light emitting dipoles interact with the plasmonic modes to increase light emission from Si NCs. This approach may be important in future work and needs to be studied further.

The second important application of semiconductor nanocrystals has been in the technology of flash memory cells. Silicon and Germanium nanocrystals in oxide matrices have been incorporated in MOS transistors as floating gates to make flash memory storage devices [15]. Feasibility or competitiveness of such devices depends on few parameters. Among these parameters are, the flat-band shift at a given write voltage, write time to achieve the specified voltage shift in the device characteristics, erase times and hold times over the specified temperature range [16]. Motorola had announced as early as 2002 that they achieved feasible performance using nanocrystals. In order to be competitive with conventional floating gate memories, hold (retention) times need to be improved by an order of magnitude [17]. Moreover, high density nanocrystal storage is being considered as DRAM replacements. Such devices are to be designed to have read/write/erase times on the order of nanoseconds, and retention times on the order of days and uniform electrical properties. These could replace certain portions of a computers memory allowing memory retention between reboots. Flash memories are even considered as hard disk replacements. A competitor to flash memories using nanocrystals is the magnetic memory that recently demonstrated high write speeds [18]. SEMINANO consortium has been able to produce high density, low dispersion Ge nanocrystals using PECVD technique [19]. MOS devices incorporating these nanocrystals exhibit large voltage shifts (1-5 V), relatively low (less than 5 volts for 0.5 V memory windows) write and erase voltages with reasonable retention times (1 year) at room temperature. Theoretical models have been devised to understand the dependence of these parameters on nanocrystal size and density as well as tunnel oxide properties and temperature.
A trend towards few nanocrystal devices seems to be evolving with studies of PL(C) from few nanocrystal devices for the ultimate aim of using these for flash memory devices. Charge retention in Si NC is laso being studied extensively. In a recent work, Feng et.al (E) has shown that hole retention times are much longer than electrons for Si NCs in SiO2 layer when studied with ultra high vacuum conductive tip noncontact atomic force microscopy. Similar work has been performed for Ge NCs in SiO2 matrices and hole retention times were seen to exponentially grow above a critical annealing temperature (F)

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1.2 Work performed and main achievements

1.2.1 Objectives, tasks and achievements:

- Fabrication of Si and Ge nanocrystals in SiO_2 and Al_2O_3 by conventional ion implantation was demonstrated. Process parameters to control size and distribution of nanocrystals was determined. **(18th Month).**

- Fabrication of Si and Ge in SiO_2 and Al_2O_3 by magnetron sputtering was demonstrated. Process parameters to control size and distribution of nanocrystals was determined. **(18th Month).**

- Fabrication of Si and Ge nanocrystals in SiO_2 and SiN_x by PECVD was demonstrated. Process parameters to control size and distribution of nanocrystals was determined **(18th Month).**

- Fabrication of Si nanocrystals in SiO_2 by laser source ion implantation was demonstrated. Process parameters to control size and distribution of nanocrystals was determined **(18th Month).**

- A comparison between different nanocrystal types, production techniques and matrices was made. The optimum material and process condition was determined. **(18th month).**

- The electronic structure of Si and Ge NCs was computed taking into account the presence of the dielectric matrix and band mixing. The linear optical susceptibility of NCs considering both zero-phonon and phonon-assisted transitions was computed and compared with PL measurements. Also, the quantum-confined Auger process in Si and Ge NCs was modeled which was made use of in the next phase in quantifying theoretical efficiency of NC LEDs. **(18th month).**

- CdS and PbS nanocrystals was prepared on ultrathin polymer films by chemical deposition technique. Size, shape and orientation control via polymer headgroup/metal cation interactions was demonstrated. **(18th month).**

- Growth of PbSe and PbS on GaAs substrate by the chemical deposition technique for high intensity waveguide array applications was developed. Morphology evolution and the role of the crystallographic orientation of the GaAs substrate was demonstrated. **(18th month).**

- Formation mechanisms of nanocrystals of CdS, CdSe and CdTe in SiO_2 and Al_2O_3 was understood. Process parameters affecting the size and the distribution of nanocrystals was determined. **(18th month).**

- The nanocrystals will be processed to understand the effects of **post-fabrication processes**. Annealing in H_2 atmosphere was carried out to see the effects of hydrogenation of defects **(30th month)**.

- **Oxidation of nanocrystals** in a controlled way was investigated **(30th month)**

- **Doping nanocrystals** by B and P was studied to search for more efficient structures for light emission and charge storage systems **(30th month).**

- Semiconductor **nanocrystals of $Si_{1-x}Ge_x$** was prepared by using successive ion implantation, co-sputtering and PECVD into SiO_2 and Al_2O_3 matrices. **(30th month)**

- Semiconductor **nanocrystals of SiC** was fabricated by using successive ion implantation and co-sputtering into SiO_2 matrix. **(30th month)**

- Optical properties of CdS and PbS grown on ultrathin conducting polymer and PbS and PbSe nanocrystals on GaAs substrate was determined. **(30th month)**

- MOS capacitors was fabricated on SiO_2 containing Si and Ge nanocrystals and studied by I-V, C-V. Hysteresis and retention measurements was carried out for memory applications. **(18th month)**

- Carrier dynamics was modelled, and fundamental mechanisms determining device performance will be investigated theoretically **(36th month)**.

- MOS capacitors was fabricated on SiO_2 containing $Si_{1-x}Ge_x$ and SiC nanocrystals and studied by I-V and C-V measurements. The alloy composition, the type of the matrix and the production technique was selected according to the results of WP2. Hysteresis and retention measurements was carried out for memory applications **(36th month).**

- MOS capacitors was fabricated on SiO_2 containing CdS, CdSe and CdTe nanocrystals and studied by I-V and C-V measurements. The effects of post fabrication processes such as annealing was studied for the purpose of optimization **(36th month).**
- ZnO nanocrystals will be fabricated in SiO_2 matrix by a catalytic and chemical technique. Optical and structural properties was investigated. **(36th month).**

1.2.2 Main achievements

Main achievements and progress during the whole duration of the project are described in sections under the title of workpackage progress below. A short summary of the main results and conclusions is also given below. A detailed description of the scientific and technical achievements is given in Appendix 2. More details can be obtained from the partners reports available at the project web page at http://newton.physics.metu.edu.tr/smd/seminano/.

1.2.2.1 Workpackage 1 (WP1)

WP1 aims at production, characterization and processing of elemental semiconductors, Si , Ge in matrices SiO_2, Al_2O_3, and SiN_x by using production techniques ion implantation, PECVD and sputtering. Production procedures of these structures have been studied and well understood. Some of the details of these process are given in Appendix ?? below where scientific and technological findings are presented. The nanostructures fabricated in this part of the project have been extensively characterized by many diagnostic techniques. Some special studies oriented towards measurement technique itself (such as XPS) have been conducted. As planned in the technical annex of the project, post processing of nanocrystals, such as oxidation, hydrogenization and doping have been carried out.

List of deliverables generated from WP1 activities is given in the table below. Some of these deliverables can be downloaded from the Seminano web page.

Del. no.	Deliverable name	WP no.	Date due	Status	Lead contractor
D1.1	Report on the fabrication of well defined Si and Ge nanocrystals formed in SiO_2 , Al_2O_3 and SiN_x by ion implantation, sputtering and PECVD. Process parameters to control size and distribution of nanocrystals.	WP1	01/03/2006	**DELIVERED**	SPRG (Si implant) METU (Ge-implant) BILKENT (PECVD)
D1.2	Report on the comparison of nanocrystals formed in SiO_2 by conventional and laser-driven-source ion implanters. Process parameters to control size and distribution of nanocrystals.	WP1	01/03/2006	**DELIVERED**	IPPLM, SPRG, METU
D1.3	Report on the computation of the linear optical properties and modeling of hot carrier impact ionization processes in Si and Ge nanocrystalline materials.	WP1	01/03/2006	**DELIVERED**	BILKENT

D1.4	Si wafers containing nanocrystals prepared by 4 different techniques in two matrices. At least 10 wafers will be provided.	WP1	01/03/2006	**DELIVERED**	SPRG (Si implant) METU (Ge-implant) BILKENT (PECVD)
D1.5	Effect of annealing, doping, oxidation, and defect introduction on the structural and optical properties of Si and Ge nanocrystals embedded in SiO_2 and Al_2O_3.	WP1	01/03/2007	**DELIVERED**	SPRG (Si implant) METU (Ge-implant) BILKENT (PECVD)

A list of all tasks of WP1 and their execution level evaluated by the consortium members is given as a chart below.

TASK	1 No progress	2 Less than comitted	3 Just enough	4 Well done	5 More than committed	Task keywords and remarks
1.1						Si, Ge in SiO_2 and Al_2O_3 (ion implantation)
1.2						Si, Ge in SiO_2 (PECVD)
1.3						Si, Ge in SiO_2 and Al_2O_3 (Sputtering)
1.4						Annealing (N_2, H_2)
1.5						Doping
2.1						Oxidation
2.2						HR-TEM
2.3						XRD did not work for the stress analysis
2.4						Raman
2.5						SIMS
2.6						AFM
2.7						PL
2.8						XPS
2.9						Time resolved PL
2.10						Round robin
2.11						Theory
						Ge in SiO_2
						Si in SiNx (LPCVD

1.2.2.2 Workpackage 2 (WP2)

WP2 deals with nanocrystals formed from compound or alloy semiconductor in different matrices. Formation of SiGe nanocrystals in SiO_2 matrix by magnetron sputtering, ion implantation and PECVD has been extensively studied. The formation mechanism and evolution during the post processing have been understood. Studies on the formation of ZnO, and CdSe nanocrystals in the SiO_2 and Al_2O_3 matrices continued in this period. Photonic crystals made of micropatterned Si filled with PbSe and PbS have been fabricated and characterized during this period. Also, Detectors for divalent metal cations based on ultrathin polyconjugated substrates have been produced and tested

List of deliverables generated from WP2 activities is given in the table below. Some of these deliverables can be downloaded from the Seminano web page.

Del. no.	Deliverable name	WP. no	Date due	Status	Lead contractor
D2.1	Report on the structural, compositional and morphological properties of CdS and PbS nanocrystals grown on ultrathin polymers films in a self assembled way..	WP 2	01/03/2006	**DELIVERED**	BGU
D2.2	Report on the deposition of nanocrystalline PbSe and PbS thin films on GaAs substrate.	WP 2	01/03/2006	**DELIVERED**	BGU
D2.3	Report on the fabrication of CdS, CdSe and CdTe nanocrystals in SiO_2 and Al_2O_3 matrices by using magnetron sputtering. Process parameters to control size and distribution of nanocrystals.	WP 2	01/03/2006	**DELIVERED**	UMINHO
D2.4	Samples and micrographs showing the self-assembled CdS, PbS, an PbSe nanocrystals on polymers and GaAs. Samples containing CdS, CdSe and CdTe nanocrystals in SiO_2 and Al_2O_3 .	WP 2	01/03/2006	**DELIVERED**	BGU UMINHO
D2.5	Report on the optical properties of CdS and PbS grown on ultrathin conducting polymer and PbS and PbSe nanocrystals on GaAs substrate. Samples with optical spectra will be provided.	WP 2	01/03/2007	**DELIVERED**	BGU
D2.6	Report on the structural and optical properties of $Si_{1-x}Ge_x$ nanocrystals in SiO_2 , Al_2O_3 and SiN_x by ion implantation, sputtering and PECVD. Process parameters to control size and distribution of nanocrystals.	WP 2	01/03/2007	**DELIVERED**	SPRG METU BILKENT
D2.7	Si wafers containing $Si_{1-x}Ge_x$ nanocrystals in SiO_2 , Al_2O_3 and SiN_x prepared by three different techniques. At least 10 wafers will be delivered	WP 2	01/03/2007	**DELIVERED**	SPRG METU BILKENT

D2.8	Report on the theoretical calculation of the phonon and electron densities of states in quantum-confinement structures. Theoretical modeling of optical and FTIR spectra of nanostructures.	WP 2	01/09/2007	**DELIVERED**	BILKENT
D2.10	Report on the structural and optical properties of SiC nanocrystals in SiO_2 by sequential ion implantation. Process parameters to control size and distribution of nanocrystals.	WP 2	01/09/2007	**DELIVERED**	METU
D2.11	Si wafers containing SiC nanocrystals in SiO_2 prepared by sequential ion implantation.	WP 2	01/09/2007	**DELIVERED**	METU

A list of all tasks of WP2 and their execution level evaluated by the consortium members is given as a chart below.

TASK	1 No progress	2 Less than comitted	3 Just enough	4 Well done	5 More than committed	Remark
1.1						SiGe in SiO2 and Al_2O_3 (ion implantation)
1.2						SiGe in SiNx (PECVD)
1.3						SiGe in SiO2 (Sputtering)
1.4						SiC in SiO2 (ion
1.5						ZnO in SiO2
1.6						CdS, CdSe, CdTe in SiO2
1.7						PbS, CdS on polymer
1.8						Annealing oxidation
1.9						HREELS, XPS
2.1						HR-TEM
2.2						XRD
2.3						Raman
2.4						FTIR
2.5						SIMS
2.6						PL
2.8						Time resolved PL
2.9						Round robin experiments
						SiC in SiO2 (annealing in CO)

1.2.2.3. Wokpackage 3 (WP3)

Workpackage 3 focuses on the application of nanocrystals to light emitting and memory devices.. MOS capacitors containing elemental (Si and Ge) and alloy (SiGe) and compound (SiC, CdSe, ZnO) have been fabricated and tested. Charge storage properties of these devices have been determined. Light emission (electroluminescence) has been obtained from the MOS-LED devices containing different nanocrystals have been prepared and characterized.

List of deliverables generated from WP3 activities is given in the table below. Some of these deliverables can be downloaded from the Seminano web page.

Del. no.	Deliverable name	Workpackage no.	Date due	Status	Lead contractor
D3.1	Report on the fabrication and analysis of Light Emitting Devices and MOS memory elements based on group IV elemental semiconductor nanocrystals.	WP3	01/09/2006	**DELIVERD**	MTA MFA
D3.2	Report on the charge storage behavior and light emitting characteristics of MOS system based on compound (SiC, CdS, CdSe, CdTe) and alloy ($Si_{1-x}Ge_x$) semiconductor nanocrystals.	WP3	01/09/2007	**DELIVERED**	MTA MFA
D3.3	Report on the modeling of carrier dynamics and radiative/non-radiative mechanisms characterizing electroluminescence and LED performance; computation of the third-order nonlinear susceptibility of Si and Ge NCs.	WP3	01/09/2007	**DELIVERED**	BILKENT
D3.4	Computer software for D3.3	WP3	01/09/2007	**DELIVERED**	BILKENT
D3.5	Demonstration of prototype of light emitters/detectors made of CdS and PbS nanocrystal arrays on ultrathin conducting polymer.	WP3	01/09/2007	**DELIVERED**	BGU
D3.6	Prototype arrays of high intensity waveguides mad of PbS and PbSe nanocrystals on micropatterned GaAs. Theoretical modeling of interference of waveguides for amplification.	WP3	01/09/2007	**DELIVERED**	BGU
D3.7	Demonstration of Light Emitting Devices and single memory element (MOS) based on elemental and alloy semiconductor nanocrystals	WP3	01/09/2007	**DELIVERED**	MTA MFA
D3.8	Report on the structural and optical properties of ZnO nanocrystals and their applications to MOS-LED devices.	WP3	01/09/2007	**DELIVERED**	GU

A list of all tasks of WP2 and their execution level evaluated by the consortium members is given as a chart below.

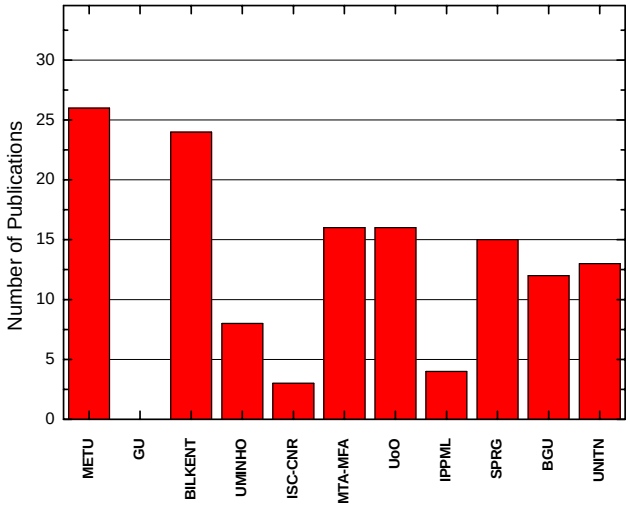
TASK	1 No progress	2 Less than comitted	3 Just enough	4 Well done	5 More than committed	Remark
1.1						MOS-LEDs with Si, Ge
1.2						Electrical measurements
1.3						Flash memory cells w. Si
1.4						theory
2.1						MOS devices w. SiGe, SiC
2.2						Electrical and optical measurements
2.3						Theory
3.1						MOS devices w. CdTe,CdS
3.2						Electrical and optical measurements
4.1						CdS and PbS nanocrytal arrays on ultrathin conducting polymer and
						Electroluminescence (EL) measurements
NEW						Light emission from SiO2 (EL)
NEW						Light emission from Si substrate (EL)
NEW						Quantum confined Stark effect : optical modulators

1.2.3 Scientifc publications

Seminano project has focused on a wide spectrum of the scientific and technical problems of semiconductor nanocrystals and their applications. Consortium members have generated new knowledge and methodology on both fundamental and application problems. Some of these new findings have been published in internationally recognized scientific journals. Total number of journal paper with Seminano acknowledgment will reach 120. Among these papers, about 60 papers have been generated as a result of collaboration between consortium members. This number reflects the collaborative efforts created within the consortium.

Number of papers with seminano acknowledgment in SCI journals (published or accepted for publication)	88
Number of submitted paper	24
Total number of expected publication	115
Total number of joint publication	60

Below the distribution of the papers (with seminano acknowledgement) among the consortium members is shown. It is seen that seven members of the consortium has published more than 10 papers during three years period of the project.

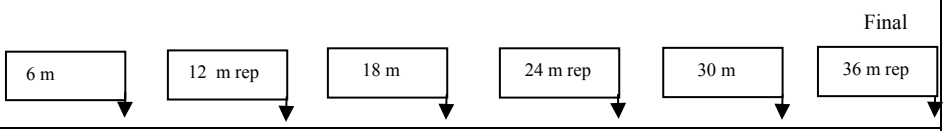


1.2.4 Project time table and status

The official document showing a self evaluation of the project activities is shown below.

PROJECT BARCHART and STATUS

Acronym: **SEMINANO**
Contract No: **505285-1**



	Duration: 1st year	2nd year	3rd year
Workpackage 1: Effects of host matrix, production techniques and processing conditions …..			
Task 1.1:Preparation and processing of Si and Ge nanocrystals in SiO_2 , SiN_x, and Al_2O_3 … **Task 1.2**: Structural and Optical of nanocrystals of nanocrystals.			
Workpackage 2: Alloy and compound semiconductor nanocrystals for new generation optical and electrical devices			
Task 2.1: Preparation of alloy and compound semiconductors by different techniques. **Task 2.2**: Structural and optical characterisation of alloy and compound nanocrytals.			
Workpackage 3: Application of semiconductor nanocrystals to light emitting devices and memory elements			
Task 3.1: : Fabrication, characterisation and modelling of MOS memory elements and LED using elemental Si and Ge nanocrystals. **Task 3.2:** Fabrication, characterisation and modelling of MOS memory elements and LED using $Si_{1-x}Ge_x$ and SiC nanocrystals. **Task 3.3:** Fabrication, characterisation and modelling of MOS memory elements …. **Task 3.4:**Production and demonstration of prototype of light emitters/detectors made of CdS and PbS nanocrsytal arrays …..			

Appendix 1. List of publications during the whole period of the project

	Authors	*Date*	***Title***	***Journal***	***Reference***	**SEMINANO ACKNOWLEDGED (YES/NO)**
METU						
1	E.S.Marstein, A.E.Gunnaes, A.Olsen, T.G.Finstad, R.Turan, U.Serincan	2004	Introduction of interface states by Ge accumulation at the Si-SiO2 interface	J. Appl. Phys	Volume 96, 4308	NO
2	U. Serincan, G. Aygun and R. Turan	2005	Selective excitation and depth profiling of light emitting centers in Si implanted SiO_2	Journal of Luminescence	Volume 113, page 229-234	YES
3	G. Kartopu, S. C. Bayliss, U. Serincan, R. Turan, R. E. Hummel, Y. Ekinci, A. E. Gunnæs and T. G. Finstad	2005	Can chemically-etched Ge or Ge nanocrystals emit visible PL?	Physica Status Solidi (a)	Volume 202, page 1472-1476	NO
4	U. V. Desnica, P. Dubcek, K. Salamon, I. D. Desnica-Frankovic, M. Buljan, S. Bernstorff, U. Serincan and R. Turan	2005	The evolution of the morphology of Ge nanocrystals formed by ion implantation in SiO_2	Nuclear Instruments and Methods in Physics Research B	Volume 238, page 272-275	YES
5	U. Serincan, S. Yerci, M. Kulakci and R. Turan	2005	Evolution of SiO_2 Matrix During the Formation of Ge and Si Nanocrystals by Ion Implantation	Nuclear Instruments and Methods in Physics Research B	Volume 239, page 419-425	YES
6	S.Yerci, U. Serincan, I. Dogan, M. S. Tokay, M. Genisel, A. Aydinli and R. Turan	2006	Formation of Silicon Nanocrystals in Sapphire by Ion Implantation and the Origin of Visible Photoluminescence	Journal of Applied Physics	**100**, 74301 (2006)	**YES**
7	M. Kulakci, U. Serincan and R. Turan	2006	Electroluminescence Generated by Metal Oxide Semiconductor Light Emitting Diode (MOS-LED) with Si Nanocrystals Embedded in SiO_2 Layers by Ion Implantation	Semiconductor Science and Technology	,**21**, 1527 (2006	YES
8	U. Serincan, M. Kulakci, R. Turan, S. Foss and T. G. Finstad	2006	Variation of Photoluminescence from Si Nanostructures in SiO_2 Matrix with Si^+ Post Implantation	Nuclear Instruments and Methods in Physics Research B	In press	YES
9	Desnica UV, Buljan M, Dubcek P, Siketic Z, Radovic IB, Bernstorff S, Serincan U, Turan R	2006	Ion beam synthesis and characterization of Ge nanoparticles in SiO2	Nuclear Instruments & Methods in Physics Research	**249**: 843-846, (2006)	**YES**

				Section b		
10	J. Mayandi,T.G Finstad, S. Foss, A.Thøgersen, S, Foss, U. Serincan, R. Turan	2006	Luminescence from silicon nanoparticles in SiO2: atomic force microscopy and transmission electron microscopy studies	Physica Scripta,	T126, 77 (2006)	YES
11	M. Rosiński, J. Badziak, A. Czarnecka, P. Gasior, P. Parys, M. Pisarek, R. Turan, J.Wołowski, S. Yerci	2006	Implantation and sputtering of Ge ions into SiO_2 substrates with the use of Ge ions produced by repetitive laser pulses	Materials Science in Semiconductor Processing	9, 655 (2006).	YES
12	A Dana, I Akca, A Aydinli, T.Finstad, R. Turan	2007	Charge retention in quantized energy levels of nanocrystals	Phsica E	Vol. 38, 94 (2007).	YES
13	Mayandi,T.G Finstad, A.Thøgersen, S, Foss, U. Serincan, R. Turan	2007	Scanning Probe Measurements on Luminescent Silicon Nanoclusters in SiO_2 Films	Thin Solid Films	515, 466 (2007)	YES
14	Mayandi, T.G. Finstad, S. Foss A. Thøgersen, U. Serincan and, R. Turan	2007	Luminescence from ion beam synthesized Si nanocrystals embedded in SiO_2 films and the effect of damage on nucleation	Surface and Coating Technology	201, 8482 (2007).	YES
15	J. Wolowski, J. Badziak, A. Czarnecka, P. Parys, M. Pisarek, M. Rosinski, R. Turan, S. Yerci	2007	Application of pulsed laser deposition and laser-induced ion implantation for formation of semiconductor nano-crystallites	Laser and Particle Beams	25, 65 (2007)	YES
16	U. Serincan, M. Kulakci, R. Turan, S. Foss and T. G. Finstad	2007	Variation of Photoluminescence from Si Nanostructures in SiO_2 Matrix with Si^+ Post Implantation	Nuclear Instruments and Methods in Physics Research	B **254**, 87 (2007).	YES
17	P. Caldelas, A.G. Rolo, M.J.M. Gomes, E. Alves, A.R. Ramos, O. Conde, S. Yerci and R. Turan	2007	Raman and XRD studies of Ge nanocrystals in alumina films grown by RF-magnetron sputtering	Vacuum	Accepted in May 2007	YES
18	M. Righini, A. Gnoli, L. Razzari, U. Serincan, R. Turan	2007	Evaluation of the radiative recombination mechanism in Si nanocrystals embedded in silica matrix	Journal of . .Nanoscience and Nanotechnology	In press	YES
19	P. Basa, A. S. Alagoz, T. Lohner, M. Kulakci, R. Turan, K. Nagy, Zs. J. Horváth	2007	Electrical and ellipsometry study of sputtered SiO_2 structures with embedded Ge nanocrystals	Appl. Surf. Sci.	accepted	YES
20	S. Yerci, M. Kulakci, U. Serincan, R. Turan, M. Shandalov and Y. Golan	2007	Formation of Ge Nanocrystals in Al_2O_3 matrix	J. Nanoscience and Nanotechnology	In press	YES
21	A. Dana, I. Akça, R. Turan, T.G. Finstad and A. Aydinli	2007	A figure of merit for optimization of nanocrystal flash memory design	J. of Nanoscience and Nanotechnology	**10**, p.1-8.	YES
22	M. Kulakci, U. Serincan, R. Turan	2007	Quantum confined Stark Effect in Si nanocrystals	Applıed Physics Letters	Submitted	YES
23	N. Ashgar, S. Yerci, R. Turan	2007	Cor-shell formation in SiGe nanocrystals	Applied Physics Letters	Submitted	YES

24	A. Gencer, R. Turan	2007	FTIR	Thin Solid Films	Submitted	YES
25	I. Akca, A. Dana, R. Turan, A. Aydinli	2007	Comparison of electron and hole charge-discharge dynamics of germamiım nanocrystal flash memories	Appl. Phys. Lett.	submitted	YES
26	L. Razzari, A. Gnoli, U. Serincan, R. Turan, and M. Righini	2007	Evidence of quantum confinement in radiative emission of non-hydrogenated Si nanocrystals embedded in SiO2 matrix	Journal of Luminescence	submitted	YES
27	J. Wolowski, J. Badziak, A. Czarnecka, P. Parys, M. Pisarek, M. Rosinski, R. Turan and S. Yerci	2007	Applications of ions produced by low intensity repetitive laser pulses for implantation into semiconductor materials.	Radiation Effects & Defects in Solids.	Sub-mitted	YES
28	D.I. Tetelbaum, A.N. Mikhaylov, O.N. Gorshkov, A.P. Kasatkin, V.A. Burdov, A.V. Ershov, A.I. Belov, D.A. Kambarov, V.K. Vasiliev, A.I. Kovalev, D.L. Wainstein, D.M. Gaponova, R. Turan, S. Yerci, L. Pavesi, L. Ferraioli, T.G. Finstad, S. Foss	2006	Properties of silicon nanocrystals formed and doped by the method of ion implantation in various oxide matrices	Nanotehnika (in Russian)	No.3. – P.36-52	YES
NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (METU)						26
GU						
1	M. Willander, O. Nur, Yu. E. Lozovik, S. M. Al Hilli, Z. Chiragwandi, Q.-H. Hu, Q. X. Zhao, and P. Klason	2005	Solid and Soft nanostructured materilas: fundanetals and applications.	Microelectronics Journal	Volume 36, page 940	NO
2	Q.X. Zhao, P. Klason, M. Willander, P. J. Begman, W. L. Jiang, and J. H. Yang	2005	Synthesis of ZnO nano-structures grown on Si susbstrates	Physica Scripta	Vol. TI 131-134 (2006).	NO
NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (GU)						0
BILKENT						
1	A. Dana, A.Aydinli, T. Finstad, R. Turan	2007	Storage of Carriers in Quantized Levels of Nanocrystals for Memory	Physica E	38 (2007) 94.	YES
2	S. Agan, A. Dana and A.Aydinli	2006	TEM studies of Ge nanocrystals formation in PECVD grown SiO2:Ge/SiO2 multilayers	J. Phys.: Condensed Matter	**18**, 5037-5045	YES
3	S. Agan, A.Çelik-Aktas, J.M. Zuo, A. Dana and A.Aydinli	2006	Synthesis and size differentiation of Ge nanocrystals in amorphous SiO_2	Applied Physics A	**83**, 107-110	YES
4	A.Dana, S. Tokay, A.Aydinli	2006	Formation of Ge Nanocrystals and SiGe in PECVD Grown SiNx:Ge Thin Films	Materials Science in Semiconductor Processing	**9**, 848-852.	YES
5	S. Yerci, U. Serincan, I.Dogan, S.Tokay, M.Genisel, A.Aydinli, R. Turan	2006	Formation of Si Nanocrystals in Sapphire by Ion Implantation and the Origin of visible	Journal of Applied Physics	**100**, 1	YES

			Photoluminescence			
6	A. Dane, U. K. Demirok, A. Aydinli, S. Suzer	2006	X-ray photoelectron spectroscopic analysis of Si nanoclusters in SiO2 matrix	Journal of Physical Chemistry B	**110**, 1137	YES
7	A. Dana, S. Ağan, S. Tokay, A. Aydınlı, T. G. Finstad	2007	Raman and TEM Studies of Ge nanocrystal formation in siOx:Ge/SiOx multilayers	Phys. Stat. Sol.	(c) 2 (2007) 288	YES
8	S. Foss, T.G.Finstad, A. Dana, A.Aydinli	2007	Growth of Ge nanoparticles on SiO2/Si interfaces during annealing of plasma enhanced cehamical vapor deposited thin films	Thin Solid Films	515 (2007) 6381.	YES
9	A. Dana, I. Akça, R. Turan, T.G. Finstad and A. Aydinli	2007	A figure of merit for optimization of nanocrystal flash memory design	J. of Nanoscience and Nanotechnology	**10**, p.1-8.	YES
10	I. Akca, A. Dana, R. Turan, A. Aydinli	2007	Comparison of electron and hole charge-discharge dynamics of germamiım nanocrystal flash memories	Appl. Phys. Lett.	submitted	YES
11	P. Basa, P. Petrik, M. Fired, A. Dana, A. Aydinli, S. Foss, T.G.Finstad.		Spectroscopic ellipsometric study of Ge nanocrystals embedded in SiO2 using parametric models	Phys. Stat. Sol. (a)	accepted	YES
12	L. Razzari, A. Gnoli, M. Righini, A. Dana, A. Aydinli	2006	Excited State dynamics and nonlinear response of Ge nanocrystals embedded in silica matrix	Appl. Phys. Lett.	**88,** 181901	YES
13	C. Sevik, and C. Bulutay	2006	High-dielectric constant and wide band gap inverse silver oxide phases of the ordered ternary alloys of SiO2, GeO2, and SnO2	Physical Review B	Volume 74, page 193201 (4 pages)	YES
14	C. Sevik, and C. Bulutay	2006	Novel high-K inverse silver oxide phases of SiO2, GeO2, SnO2 and their alloys	Materials Science in Semiconductor Processing	Volume 9, page 1097-1101	YES
15	C.Bulutay	2006	Pseudopotential-based full zone k.p technique for indirect bandgap semiconductors: Si, Ge, diamond and SiC	Turkish Journal of Physics	Volume 30, page 287-294	YES
16	C. Sevik and C. Bulutay	2007	Elements of nanocrystal high-field carrier transport modeling	Physica Status Solidi C	Volume 4, page 635-637	YES
17	C. Bulutay	2007	Electronic Structure and Optical Properties of Silicon Nanocrystals along their Aggregation Stages	Physica E	Volume 38, page 112-117	YES
18	C. Sevik and C. Bulutay	2007	Computational modeling of quantum-confined impact ionization in Si nanocrystals embedded in SiO2	Physica E	Volume 38, page 118-121	YES
19	C. Sevik and C. Bulutay	2007	Theoretical study of the insulating oxides and nitrides: SiO2, GeO2,	Journal of Materials Science	Volume 42, page 6555-6565	YES

			Al2O3, Si3N4, and Ge3N4			
20	D. E. Yilmaz, C. Bulutay, and T. Cagin	2007	Atomistic Structure simulation of silicon nanocrystals driven with suboxide penalty energies	Journal of Nanoscience and Nanotechnology	In press	YES
21	C. Bulutay	2007	Interband, intraband and excited-state direct photon absorption of silicon and germanium nanocrystals embedded in a wide band-gap lattice	Physical Review B	Accepted	YES
22	H. Yıldırım and C. Bulutay	2007	Third-order nonlinearities of silicon nanocrystals embedded in wide band-gap host matrices	Nano Letters	Submitted	YES
23	C. Sevik and C. Bulutay	2007	Atomistic theoretical modelling of Auger recombination in silicon nanocrystals embedded in SiO2 and Al2O3	Physical Review Letters	Submitted	YES
16	D. Wainstein, A. Kovalev, D. Tetelbaum, A. Mikhailov, C. Bulutay, A. Aydinli	2007	Experimental and theoretical investigations of electronic and atomic structure of Si-nanocrystals formed in sapphire by ion implantation	Journal of Physics	submitted	YES
NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (BILKENT)						24
UMINHO						
1	P. Caldelas, A.G. Rolo, A. Chahboun, S. Foss, S. Levichev, T.G. Finstad, M.J.M. Gomes, and O. Conde	2007	Structural and Optical Properties of Ge Nanocrystals Embedded in Al_2O_3	Journal of Nanoscience and Nanotechnology	Accepted .To be published in 2007	YES
2	S. Levichev, M. Mamor, A.G. Rolo, S.R.C. Pinto, A. Khodorov, and M.J.M. Gomes	2007	Electrical conduction of CdSe nanocrystals embedded in silicon oxide films.	Journal of Nanoscience and Nanotechnology	Submitted in July 2007	YES
3	P. Caldelas, A.G. Rolo, M.J.M. Gomes, E. Alves, A.R. Ramos, O. Conde, S. Yerci and R. Turan	2007	Raman and XRD studies of Ge nanocrystals in alumina films grown by RF-magnetron sputtering	Vacuum	Accepted in May 2007	YES
4	A. G. Rolo and M. I. Vasilevskiy	2007	Raman spectroscopy of optical phonons confined in semiconductor quantum dots and nanocrystals	JOURNAL OF RAMAN SPECTROSCOPY 2007; 38: 618–633.		YES
5	A. Chahboun, A.G. Rolo, S.A. Filonovich, M. J. M. Gomes	2006	Factors influencing the Passivation of CdS Quantum Dots Embedded in Silica Glass	*Solar Energy Materials & Solar Cells*, 90 (10) (2006) 1413–1419		NO
6	A.G. Rolo, A. Chahboun, O. Conde, M. J. M. Gomes	2007	Annealing effect on the photoluminescence of Ge doped silica films	*Physica B*	Accepted .To be published in 2007.	YES

7	Rafael P. Miranda and Mikhail I. Vasilevskiy, Carlos Trallero-Giner	2006	Nonperturbative approach to the calculation of multiphonon Raman scattering in semiconductor quantum dots: Polaron effect	PHYSICAL REVIEW B **74**, 115317 _2006_		YES
8	A. I. Belogorokhov, I. A. Belogorokhov, R. P. Miranda, M. I. Vasilevski and S. A. Gavrilov		Polar Optical Phonons in Semiconducting CdS Nanocrystals	Journal of Experimental and Theoretical Physics, 2007, Vol. 104, No. 1, pp. 111–119.		YES
9	S. Levichev, A.G. Rolo, A. Chahboun, O. Conde, M.J.M. Gomes, A.I. Kovalev, and D.L. Wainstein		Confinement effect in CdTe nanocrystals embedded in silica thin films"	Physica Status Solidi (a)	Submitted in September 2007	YES
NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (UMINHO)						8
ISC-CNR						
1	A. Gnoli, L. Razzari, M.Righini	2005	Z-scan measurements using high repetition rate lasers: how to manage thermal effects	Opt. Express	Volume 13, Page 7976	YES
2	L. Razzari, A. Gnoli, M. Righini, A. Dana, A. Aydinli	2006	Excited-state dynamics and nonlinear optical response of Ge nanocrystals embedded in silica matrix	Applied Physics Letters	Volume 88, page 181901	YES
3	M. Righini, A. Gnoli, L. Razzari, U. Serincan, R. Turan	2007	Evaluation of the radiative recombination mechanism in Si nanocrystals embedded in silica matrix	Journal of . .Nanoscience and Nanotechnology	In press	YES
4	L. Razzari, A. Gnoli, U. Serincan, R. Turan, and M. Righini	2007	Evidence of quantum confinement in radiative emission of non-hydrogenated Si nanocrystals embedded in SiO2 matrix	Journal of Luminescence	submitted	YES
NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (ISC-CNR)						4
MTA-MFA						
1	Zs. J. Horváth	2006	Semiconductor nanocrystals in dielectrics: Optoelectronic and memory applications of related silicon based MIS devices	Current Appl. Phys.	Volume 6, Page 145-148.	YES
2	Zs. J. Horváth	2006	Electrical pecularities in GaAs and Si based low dimensional structures	Current Appl. Phys.	Volume 6, Page 205-211.	YES
3	P. Szöllõsi, P. Basa, Cs. Dücsõ, B. Máté, M. Ádám, T. Lohner, P. Petrik, B. Pécz, L. Tóth, L. Dobos, L. Dózsa, Zs. J. Horváth	2006	Electrical and optical properties of Si-rich SiN_x layers: Effect of annealing	Current Appl. Phys.	Volume 6, Page 179-181.	YES
4	V. Rakovics, Zs. J. Horváth, Z. E. Horváth, I. Bársony, C. Frigeri, T.	2007	Investigation of CdS/InP heterojunction prepared by	Phys. Stat. Sol. (C)	Volume 4 Page 1490-	YES

	Besagni		chemical bath deposition		1493.	
5	P. Basa, Zs. J. Horváth, T. Jászi, A. E. Pap, L. Dobos, B. Pécz, L. Tóth, and P. Szöllősi	2007	Electrical and memory properties of silicon nitride structures with embedded Si nanocrystals	Physica E	Volume 38 page 71-75	YES
6	P. Basa, P. Petrik, M. Fried, L. Dobos, B. Pécz, L. Tóth	2007	Si nanocrystals in silicon nitride: an ellipsometric study using parametric semiconductor models	Physica E	Volume 38 page 76-79	YES
7	D.L. Wainstein, A.I. Kovalev, Cs. Ducso, T. Jaszi, P. Basa, Zs.J. Horvath, T. Lohner, P. Petrik	2007	X-ray photoelectron spectroscopy investigations of Si in non-stoichiometric SiN_X LPCVD multilayered coatings	Physica E	Volume 38 page 156-159	YES
8	Zs. J. Horváth, P. Basa, T. Jászi, A. E. Pap, L. Dobos, B. Pécz, L. Tóth, P. Szöllősi, V. Hardy	2007	Electrical and memory properties of Si_3N_4 MIS structures with embedded Si nanocrystals	J. Nanoscience Nanotechnol.	accepted	YES
9	Zs. J. Horváth, V. Hardy	2007	Simulation of memory behaviour of non-volatile structures	J. Nanoscience Nanotechnol.	accepted	YES
10	P. Basa, Gy. Molnár, L. Dobos, B. Pécz, L. Tóth, A. L. Tóth, A. A. Koós, L. Dózsa, Á. Nemcsics, Zs. J. Horváth	2007	Formation of Ge nanocrystals in SiO_2 by electron beam evaporation	J. Nanoscience Nanotechnol.	accepted	YES
11	P. Basa, A. S. Alagoz, T. Lohner, M. Kulakci, R. Turan, K. Nagy, Zs. J. Horváth	2007	Electrical and ellipsometry study of sputtered SiO_2 structures with embedded Ge nanocrystals	Appl. Surf. Sci.	accepted	YES
12	P. Basa, P. Petrik, M. Fried, A. Dâna, A. Aydinli, S. Foss, T. G. Finstad	2007	Spectroscopic ellipsometric study of Ge nanocrystals embedded in SiO_2 using parametric models	Phys. Stat. Sol.	submitted	YES
13	Zs. J. Horváth, T. Jászi, A. E. Pap, G. Molnár, Cs. Dücső, P. Basa, K. Nagy, L. Dobos, B. Pécz, L. Tóth, P. Szöllősi, T. Szabó	2007	Si_3N_4 based nanocrystal memory structures	Appl. Surf. Sci.	submitted	YES
14	Zs. J. Horváth, V. Rakovics	2007	Electrical behaviour of nanocrystalline CdS/InP heterojunction p-n diodes	Appl. Surf. Sci.	submitted	YES
15	P. Basa, P. Petrik	2005	SiN_x/nc-Si/SiN_x multilayers: A spectroscopic ellipsometric study	Romanian J. Information Science and Technology	Volume 8, Page 235-240.	YES
16	A. Pongrácz, G. Battistig, Cs. Dücső, K.V. Josepovits, P. Deák	2007	Structural and electronic properties of Si/SiO2 MOS structures with aligned 3C–SiC nanocrystals in the oxide	Materials Science and Engineering C	accepted	YES
TOTAL NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (MTA MFA)						16
UoO						
1	E.S.Marstein, A.E.Gunnaes, A.Olsen, T.G.Finstad, R.Turan, U.Serincan	2004	Introduction of interface states by Ge accumulation at the Si-SiO2 interface	J. Appl. Phys	Volume 96, 4308	NO
2	C. L.Heng, T.G. Finstad, Y. J. Li,	2005	Ge nanoparticle formation	Microelectronics	Volume	NO

	A. E. Gunnæs, A. Olsen, P. Storås		and photoluminescence Er doped SiO2 films: influence of sputter gas and annealing.	Journal	36, 531	
3	C. L.Heng and T. G. Finstad	2005	Electrical characteristics of a metal-insulator-semiconductor memory structure containing Ge nanocrystals	Physica E-Low-Dimensional Systems & Nanostructures	Volume 26, 286	NO
4	J. Mayandi, T.G. Finstad, S. Foss A. Thøgersen, U. Serincan and, R. Turan	2006	Luminesce of Si nanocrystals in SiO2 films: microstructure studies by scanning probe and energy filtered elctron microscopy	Physica Scripta	Volume T126 page 77-80	YES
5	U. Serincan, M. Kulakci, R. Turan, S. Foss and T. G. Finstad	2007	Variation of Photoluminescence from Si Nanostructures in SiO_2 Matrix with Si^+ Post Implantation	Nuclear Instruments and Methods in Physics Research B	Volume 254, page 87-92	YES
6	A. Dana, I. Akca, O. ErgunA. Aydinli, R. TuranT.G. Finstad	2007	Charge Retention in Quantized Energy Levels of Nanocrystals.	Physica E	Volume 38, page94-98	YES
7	G. Kartopu, V.A.Karavinskii, U. Serincan, R. Turan, R.E. Hummel, Y. Ekinci, A.E. Gunnæs, T. G. Finstad	2005	"Can chemically etched germanium or germanium nanocrystals emit visible photoluminescence?"	Physica Status Solidi A,	**202**, 1472 (2005)	NO
8	C.L. Heng, Y.J. Li, J. Mayandi, T.G. Finstad, S. Jørgensen, A.E. Gunnæs, P. Storås, A. Olsen	2006	"A study on the precipitation of Ge-rich nanoparticles in a luminescent (Er, Ge) co-doped SiO_2 film sputtered with $Ar+O_2$ plasma	International Journal of Nanoscience,	**5**, 493 (2006)	NO
9	J. Mayandi, T.G. Finstad, S. Foss A. Thøgersen, U. Serincan and, R. Turan,	2007	"Ion beam synthesized luminescent Si nanocrystals embedded in SiO 2 films and the role of damage on nucleation during annealing".	Surface and Coating Technology,	Volume 201 page 8482 – 8485	YES
10	J. Mayandi,T.G Finstad, A.Thøgersen, S, Foss, U. Serincan, R. Turan	2007	Scanning Probe Measurements on Luminescent Silicon Nanoclusters in SiO_2 Films Films	Thin Solid Films	Volume 515 page 6375-6380	YES
11	S. Foss, T.G. Finstad, A. Dana, A. Aydinli,	2007	"Growth of Ge Nanoparticles on SiO2 / Si Interfaces during Annealing of Plasma Enhanced Chemical Vapor Deposited Thin Film.	Thin Solid films,	Volume 515, page 6381-6384	YES
12	C. L. Heng, T.G. Finstad, Y. J. Li, S. Jørgensen, A. Olsen,,	2007	A structural study on an (Er, Ge) co-doped SiO_2 film using transmission electron microscopy and X-ray photoelectron spectroscopy	Appl. Phys. Lett.,	submitted	YES
13	J. Mayandi, T.G. Finstad, S.Foss, C.L Heng, H. Klette,	2007	"Infrared Electroluminescence from	Journal of Luminescence.	**127**, 362-366	NO

			a Si MOS Structure with Ge in the Oxide			
14	P. Basa, P. Petrik, M. Fried, A. Dana, A. Aydinli, S. Foss, T.G. Finstad	2007	Spectroscopic ellipsometric study of Ge nanocrystals embedded in SiO2 using parametric models.	Physica status solidi. A, Applied research 2007	In Press	YES
15	U. SerincanM. Kulakci, R. Turan, S. Foss, T.G. Finstad	2007	Variation of photoluminescence from Si nanostructures in SiO2 matrix with Si+ post implantation.	Nuclear Instruments and Methods in Physics Reseach B	Volume 254 page 87-92	YES
16	D.I.Tetelbaum, O.N. Gorshkov, A.V. Ershov, A.P. Kasatkin, V.A.Kamin, A.N. Mikhaylov, A.I. Belov, D.M. Gapanova, L.Pavesi, L. Ferraioli, S.Foss, T.G.Finstad	2006	Influence of the nature of oxide matrix on the photoluminescence spectrum of ion-synthesized silicon nanostructures.	Thin Solid Films	Volume 515, page 333-337	YES
17	J.Mayandi, T.G. Finstad, C.L.Heng,Y.J.Li, A.Thøgersen, S. Foss and H. Klette.	2007	A comparison between 1.5μm PL from (Er,Si) and (Er,Ge) co-doped SiO2 films	*Microelectronics Journal*	accepted	YES
18	J.Mayandi, T.G. Finstad, S. Foss,	2007	1.5 μm photo-luminescence from (Er,Si,Ge) co-sputterd with Al2O3 on Si	*European Journal of Applied Physics*	submitted	YES
19	A. Thogersen, S. Diplas, J. Mayandi, and T. G. Finstad, A. Olsen J.F. Watts, M. Mito	2007	An experimental study of charge distribution in crystalline and amorphous nanoclusters of silicon, in a thin silica film.	*Thin Solid Films*	submitted	NO
20	J.Mayandi, T.G. Finstad, S. Foss, H. Klett, H. Sagberg	2007	(Ge,Er) co-doped sputtered SiO2 films and the effect of voids on their stability.	*Journal of nanoparticle research*	submitted	YES
21	P. Caldelas, A. G. Rolo , A. Chahboun, S. Foss , S. Levichev, T. G. Finstad, M. J. M. Gomes, and O. Conde	2007	Structural and Optical Properties of Ge Nanocrystals Embedded in Al2O3	Journal of Nanoscience and Nanotechnology	In Press	YES
22	S. Foss and T.G.Finstad	2007	A method forincreased sensitivity to amorhous Si nanoclusters in embedded in amorphous SiO2	*Ultramicroscopy*	submitted	YES
23	A. Dana, I. Akça, R. Turan, T.G. Finstad and A. Aydinli	2007	A figure of merit for optimization of nanocrystal flash memory design	J. of Nanoscience and Nanotechnology	In press	YES
NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (UoO)						16
IPPML						
1	M. Rosiński, J. Badziak, A. Czarnecka, P. Gasior, P. Parys, M. Pisarek, R. Turan, J.Wołowski, S. Yerci	2006	Implantation and sputtering of Ge ions into SiO_2 substrates with the use of Ge ions produced by repetitive laser pulses	Materials Science in Semiconductor Processing	9, 655 (2006).	YES
2	J. Wolowski, J. Badziak, A. Czarnecka, P. Parys, M. Pisarek, M. Rosinski, R. Turan, S. Yerci	2007	Application of pulsed laser deposition and laser-induced ion implantation for formation of semiconductor nano-crystallites	Laser and Particle Beams	25, 65 (2007)	YES
3	M. Rosiński, J. Wolowski,J.	2006	Direct implantation of Ge	Phisica Scripta	Vol. T123,	NO

	Badziak, P. Boody,S. Gammino, J. Krása, L. Láska, A. Mezzasalma, P. Parys, M. Pfeifer, K. Rohlena, L. Torrisi,J. Ullschmied, J. Wolowski.		ions produced by high-energy low-intensity laser pulses into SiO_2 films on the Si substrates		pages:148-151	
4	M. Rosiński, J. Wołowski, J. Badziak, F. Boody, S. Gammino, J. Krasa, L. Laska, A. Mezzasalma, P. Parys[1], M. Pfeifer, K. Rohlena, L. Torrisi, J. Ullschmied	2006	Investigation of plasma produced by high-energy low-intensity laser pulses for implantation of Ge ions into Si and SiO2 substrates.	Proc. of the American Institute of Physics	**Vol. 812**, 2006, 303-306	NO
5	J. Wolowski, J. Badziak, A. Czarnecka, P. Parys, M. Pisarek, M. Rosinski, R. Turan and S. Yerci	2007	Applications of ions produced by low intensity repetitive laser pulses for implantation into semiconductor materials.	Radiation Effects & Defects in Solids.	Sub-mitted	YES
6	A. Czarnecka, J. Badziak, P. Parys, M. Rosiński, J. Wołowski	2007	Method of ions acceleration for laser-induced implantation of semiconductor materials.	Radiation Effects & Defects in Solids.	Sub-mitted	YES
NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (IPPML)						4
SPRG						
1	D.I. Tetelbaum, O.N. Gorshkov, V.A. Burdov, S.A. Trushin, A.N. Mikhaylov, D.M. Gaponova, S.V. Morozov, A.I. Kovalev	2004	The Influence of P^+, B^+, and N^+ Ion Implantation on the Luminescence Properties of the SiO_2:nc-Si System	Phys. Sol. State	Vol.46. No.1. P.17-21	NO
2	V.A. Belyakov, V.A. Burdov, D.M. Gaponova, A.N. Mikhaylov, D.I. Tetelbaum, S.A. Trushin	2004	Phonon-assisted radiative electron-hole recombination in silicon quantum dots	Phys. Sol. State	Vol.46. No.1. P.27-30	NO
3	G.A. Kachurin, V.A. Volodin, D.I. Tetel'baum, D.V. Marin, A.F. Leer, A.K. Gutakovski, A.G. Cherkov, A.N. Mikhaylov	2005	The formation of silicon nanocrystals in SiO_2 layers by the implantation of Si ions with intermediate heat treatments	Semiconductors	Vol.39, No.5. P.552-556	NO
4	O.N. Gorshkov, Yu.A. Dudin, V.A. Kamin. A.P. Kasatkin, A.N. Mikhaylov, V.A. Novikov, D.I. Tetelbaum	2005	Photoluminescence of $Si_{0.9}Ge_{0.1}O_2$ and GeO_2 films irradiated with silicon ions	Tech. Phys. Lett.	Vol.31, No.6. P.509-512	NO
5	D.I. Tetelbaum, O.N. Gorshkov, A.P. Kasatkin, A.N. Mikhaylov, A.I. Belov, D.M. Gaponova, S.V. Morozov	2005	Effect of coalescence and of the character of the initial oxide on the photoluminescence of ion-synthesized Si nanocrystals in SiO_2	Phys. Sol. State	Volume 47. No.1. Page 13-17	YES
6	A.N. Mikhaylov, D.I. Tetelbaum, O.N. Gorshkov, A.P. Kasatkin, A.I. Belov, S.V. Morozov	2005	Ion beam synthesis of Si nanocrystals in silicon dioxide and sapphire matrices – the photoluminescence study	Vacuum	Vol.78. No.2-4. P.519-524	YES
7	A. Kovalev, D. Wainstein, D. Tetelbaum, A. Mikhailov	2006	The peculiarities of electronic structure of Si nanocrystals formed in SiO_2 and Al_2O_3 matrix with and without P doping	Surface and Interface Analysis	Vol.38, P.433-436	YES
8	D.I. Tetelbaum, O.N. Gorshkov, A.V. Ershov, A.P. Kasatkin, V.A. Kamin, A.N. Mikhaylov, A.I. Belov, D.M. Gaponova, L. Pavesi,	2006	Influence of the nature of oxide matrix on the photoluminescence spectrum of ion-synthesized	Thin Solid Films	Volume 515, page 333-337	YES

	L. Ferraioli, T.G. Finstad, S. Foss		silicon nanostructures			
9	A. Kovalev, D. Wainstein, D. Tetelbaum	2006	Investigation of electronic structure of Si nanocrystals and their interface with host matrix in P-doped SiO_2:Si and Al_2O_3:Si nanocomposites	Thin solid films	Vol.515, P.591-595	YES
10	D.I. Tetelbaum, A.N. Mikhaylov, O.N. Gorshkov, A.P. Kasatkin, V.A. Burdov, A.V. Ershov, A.I. Belov, D.A. Kambarov, V.K. Vasiliev, A.I. Kovalev, D.L. Wainstein, D.M. Gaponova, R. Turan, S. Yerci, L. Pavesi, L. Ferraioli, T.G. Finstad, S. Foss	2006	Properties of silicon nanocrystals formed and doped by the method of ion implantation in various oxide matrices	Nanotehnika (in Russian)	No.3. – P.36-52	YES
11	D.L. Wainstein, A.I. Kovalev, Cs. Ducso, T. Jaszi, P. Basa, Zs.J. Horvath, T. Lohner and P. Petrik	2007	X-ray photoelectron spectroscopy investigations of Si in non-stoichiometric SiN_x LPCVD multilayered coatings	Physica E, Low dimensional Systems and Nanostructures	Vol.38, No.1-2; P.156-159	YES
12	V.A. Terekhov, S.Yu. Turishchev, V.M. Kashkarov, E.P. Domashevskaya, A.N. Mikhailov, D.I. Tetel'baum	2007	Silicon nanocrystals in SiO_2 matrix obtained by ion implantation under cyclic dose accumulation	Physica E, Low dimensional Systems and Nanostructures	Vol.38, No.1-2; P.16-20	YES
13	A.N. Mikhaylov, D.I. Tetelbaum, V.A. Burdov, O.N. Gorshkov, A.I. Belov, D.A. Kambarov, V.A. Belyakov, V.K. Vasiliev, A.I. Kovalev, D.M. Gaponova	2007	Effect of ion doping with donor and acceptor impurities on intensity and lifetime of photoluminescence from SiO_2 films with silicon quantum dots	Journal. Nanosci. Nanotechnol	Vol.7, in press	YES
14	V. Terehov, S. Turischev, V. Koshkarev, E. Domashevskaya, A. Mikhailov, D. Tetelbaum	2007	Synchrotron investigations of electronic structure of Si nanocrystals in SiO_2 matrix	Journal of Surface Investigation (Russian)	No.1, P.61-65	NO
15	A Kovalev, D Wainstein, D Tetelbaum, A Mikhaylov, L Pavesi, L Ferrarioli, A Ershov, A Belov	2007	The electron and crystalline structure features of ion-synthesized nanocomposite of Si nanocrystals in Al_2O_3 matrix revealed by electron spectroscopy	Journal of Physics	submitted	YES
16	D. Wainstein, A. Kovalev, D. Tetelbaum, A. Mikhailov, C. Bulutay, A. Aydinli	2007	Experimental and theoretical investigations of electronic and atomic structure of Si-nanocrystals formed in sapphire by ion implantation	Journal of Physics	submitted	YES
17	A.I. Kovalev, D.L. Wainstein, D.I. Tetelbaum, A.N. Mikhailov, Y. Golan, E. Lifshitz, P. Basa, Zs.J. Horvath	2007	Electron spectroscopy investigations of semiconductor nanocrystals formed by various technologies	International journal of Nanoparticles	accepted	YES
18	D. Wainstein, A. Kovalev, D.Tetelbaum, A. Mikhailov, A.Belov	2007	Investigations of SiC semiconductor nanocrystals formed by sequential ion implantation and annealing in thermally oxidized Si.	Surface and Interface Analysis	submitted	YES

19	D. I. Tetelbaum, A. N. Mikhaylov, V. K. Vasiliev, A. I. Belov, A. I. Kovalev, D. L. Wainstein	2007	Effect of carbon implantation on visible luminescence and composition of Si-implanted SiO_2 layers	Surface and Coatings Technology	submitted	YES
20	D. Tetelbaum, A. Mikhailov, A. Belov, A. Ershov,E. Pitirimova, S. Plankina, S. Smirnov, A. Kovalev, R. Turan, S. Yerci, T.G. Finstad, S. Foss	2007-2008	Properties of Al_2O_3:nc-Si, fabricated by Si ion implantation in sapphire and amorphous Al_2O_3	Phys. Sol. State	Prepared for submission	YES
21	D.I. Tetelbaum, O.N. Gorshkov, V.A. Burdov, S.A. Trushin, A.N. Mikhaylov, D.M. Gaponova, S.V. Morozov, A.I. Kovalev	2004	The Influence of P^+, B^+, and N^+ Ion Implantation on the Luminescence Properties of the SiO_2:nc-Si System	Phys. Sol. State	Vol.46. No.1. P.17-21	NO
NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (SPRG)						15
BGU						
1	M. Shandalov and Y. Golan	2005	Microstructure and morphology evolution in chemical solution deposited semiconductor films: 3. PbSe on GaAs vs. Si substrate	2 Eur. Phys. J. Appl. Phys.	Volume 31 page 27-30	YES
2	S. Acharya, A.B. Panda, S. Efrima and Y. Golan	2006	Ultrahigh Density Arrays of Semiconductor Nanowires by the Langmuir-Blodgett Technique	Adv. Mater.	Volume 18 page 210-213	YES
3	M. Shandalov and Y. Golan	2006	Real Time Monitoring of Deposition Mechanism in Chemical Solution Deposited PbSe Films using Light Scattering	Chem. Mater.	Volume 18 page 3593-3595	YES
4	Y. Lifshitz, A. Berman, N. Belman, O. Konovalov and Y. Golan	2006	PbS, ZnS and CdS Nanocrystals on Polyacetylene Langmuir Films: An *In-Situ* Synchrotron GIXD Study	Adv. Funct. Mater.	Volume 16 page 2398-2404	YES
5	A.B. Panda, S. Acharya, S. Efrima and Y. Golan	2007	Synthesis, Assembly and Optical Properties of Shape and Phase Controlled ZnSe Nanocrystals	Langmuir	Volume 23 page 765-770	YES
6	A. Osherov, V. Ezersky and Y. Golan	2007	Microstructure and Morphology Evolution in Chemical Solution Deposited Semiconductor Films: 4. PbS on GaAs(100)	3 Eur. Phys. J. Appl. Phys.	Volume 37 page 39-47	YES
7	A. Osherov, M. Shandalov, V. Ezersky and Y. Golan	2007	Epitaxy and Orientation Control in Chemical Solution Deposited PbS and PbSe Monocrystalline Films	J. Crystal Growth	Volume 304 page 169-178	YES
8	S. Yerci, M. Kulakci, U. Serincan, R. Turan, M. Shandalov and Y. Golan	2007	Formation of Ge Nanocrystals in Al_2O_3 matrix	J. Nanoscience and Nanotechnology	In press	YES
9	A. Osherov, V. Ezersky and Y. Golan	2007	The Role of Solution Composition in Chemical Bath Deposition of Epitaxial Thin Films of PbS	J. Crystal Growth	In press	YES

			on GaAs (100)			
10	L. Zeiri, I. Patla, S. Acharya, Y. Golan and S. Efrima	2007	Raman Spectroscopy of Ultra-Narrow CdS Nanostructures	J. Phys. Chem. C	Volume 111 page 11843-11851	YES
11	A.I. Kovalev, D.L. Wainstein, D.I. Tetelbaum, A.N. Mikhailov, Y. Golan, Y. Lifshitz, A. Berman, P. Basa, Zs.J. Horvath	2007	Electron Spectroscopy Investigations of Semiconductor Nanocrystals Formed by Various Technologies	Intl. J. Nanoparticles	Accepted	YES
12	M. Shandalov, J.P. Makai, J. Balazc, N. Gutman, A. Sa'ar and Y. Golan	2007	Optical properties of size quantized PbSe films chemically deposited on GaAs	4 Eur. Phys. J. Appl. Phys.	Submitted	YES
NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (BGU)						12
UNITN						
1	M. Cazzanelli, D. Navarro-Urrios, F. Riboli, N. Daldosso, L. Pavesi, J. Heitmann, L. X. Yi, R. Scholz, M. Zacharias, U Rosele	Septe mber, 2004	Optical gain in monodispersed silicon nanocrystals	Journal of Applied Physics	Volume 96, 3164-3171	NO
2	L. Dal Negro, M. Cazzanelli, B. Danese, L. Pavesi, F. Iacona, G. Franzò and F. Priolo	Nove mber 2004	Light amplification in silicon nanocrystals by pump and probe transmission measurements	Journal of Applied Physics	Volume 96, 5747-5755	NO
3	Massimo Cazzanelli, Dmitri Kovalev, Luca Dal Negro, Zeno Gaburro, and Lorenzo Pavesi	Nove mber, 2004	Polarized optical gain and polarization-narrowing in oxidized anisotropic silicon nanocrystals	Physical Review Letters	Volume 93, 207 402	NO
4	D. S. Wiersma, R. Sapienza, S. Mujumdar, M. Ghulinyan, L. Pavesi	Februa ry, 2005	Optics of nanostructured dielectrics: from random lasers to quasi-crystals	Journal of Optics A: Pure and Applied Optics special issue on Nanostructured Optical Materials	Volume 7, S190-S197	NO
5	P. Pellegrino, B. Garrido, C. Garcia, J. Arbiol, J.R. Morante, M. Melchiorri, N. Daldosso, L. Pavesi, E. Schedi and G. Sarrabayrouse	March , 2005	Low loss rib waveguides containing Si nanocrystals embedded in SiO2	Journal of Applied Physics	Volume 97, 074312-1/8	NO
6	N. Daldosso, D. Navarro-Urrios, M. Melchiorri, L. Pavesi, F. Gorbilleau, M. Carrada, R. Rizk, C. Garcia, P. Pellegrino, B. Garrido, L. Cognolato	June, 2005	Absorption cross section and signal enhancement at 1.54 □m in Er-doped Si nanocluster rib-loaded waveguides	Applied Physics Letters	86 231103	NO
7	Elena Froner, Roberta Adamo, Zeno Gaburro, Benno Margesin, Lorenzo Pavesi, Adelio Rigo, Marina Scarpa	June, 2005	Luminescence of porous silicon derived nanocrystals dispersed in water: dependence on initial porous silicon oxidation	Journal of Nanoparticle Research	Submitted	NO
8	K. Luterová , M. Cazzanelli, J.-P. Likforman , D. Navarro, J. Valenta, T. Ostatnický, K. Dohnalová, S. Cheylan, P. Gilliot, B. Hönerlage, L. Pavesi, I. Pelant	2005	Optical gain in nanocrystalline silicon: comparison of planar waveguide geometry with a non-waveguiding ensemble of nanocrystals	Optical Materials	Volume 27, 750-755	NO
9	D. Navarro-Urrios, F. Riboli, Massimo Cazzanelli, A. Chiasera,	2005	Birefringence in optical waveguides made by silicon	Optical Materials	Volume 27, 763-768	NO

	N. Daldosso, L. Pavesi, C. J. Oton, J. Heitmann, L.X. Yi, R. Scholz and M. Zacharias		nanocrystal superlattices			
10	P. M. Fauchet, J. Ruan, H. Chen, L. Pavesi, L. Dal Negro, M.Cazzanelli, R.G. Elliman, N.Smith, M. Samoc and B. Luther-Davies	2005	Optical Gain in Different Silicon Nanocrystal Systems	Optical Materials	Volume 27, 745-749	NO
11	K. Luterová, D. Navarro, M. Cazzanelli, T. Ostatnický, J. Valenta, S. Cheylan, I. Pelant, and L. Pavesi,	2005	Stimulated emission in the active planar optical waveguide made of silicon nanocrystals	Physica Status Solidi	(c) 2, 3429-3434	NO
12	P. Bettotti, M. Cazzanelli, N. Daldosso, L. Ferraioli, Z. Gaburro, M. Ghulinyan, D. Navarro, M. Melchiorri, F. Riboli, S. Prezioso, L. Pavesi	May, 2005	Silicon nanostructures for photonics applications	proceedings of SEMINANO 2005	Submitted	YES
13	L. Pavesi	Januar y, 2005	Routes towards a silicon-based laser	Materials Today	8(1) page 18-25	YES
14	Z. Gaburro, N. Daldosso, L. Pavesi	Januar y 2005	Porous Silicon	Encyclopedia of Condensed Matter Physics edited by Franco Bassani, Jerry Liedl and Peter Wyder	In press	NO
15	N. Daldosso and L. Pavesi	July, 2005	Low dimensional Silicon as a photonic material	in Nanosilicon edited by Vijay Kumar (Elsevier, 2005)	In press	YES
16	N. Daldosso, D. Navarro-Urrios, M. Melchiorri, L. Pavesi, F. Gourbilleau, M. Carrada, R. Rizk, C. García, P. Pellegrino, B. Garrido, and L. Cognolato	2005	Pump-probe experiments on Er coupled Si-nanocrystals rib-loaded waveguides	Mat. Res. Soc. Symp. Proc	Volume 832, F11.3.1-F11.3.6	NO
17	D. Navarro-Urrios, N. Daldosso, M. Melchiorri, F. Sbrana, L. Pavesi, C. García, B. Garrido, P. Pellegrino, J.R. Morante, E.Scheid and G. Sarrabayrouse	2005	Pump-probe experiments on low loss silica waveguides containing Si nanocrystals	Mat. Res. Soc. Symp. Proc	Volume 832, F10.11.1-F10.11.6	NO
18	Lorenzo Pavesi	may 2006	Optical gain and lasing in low dimensional silicon: the quest for an injection laser	Technological Applications of Semiconductor Nanomaterials, Springer-Verlag		YES
19	Lorenzo Pavesi	2006	Photonics applications of nano-silicon	Frontiers in Optical Technology: Materials and Devices (Inc.,2006)		YES
20	Z. Gaburro, P. Bettotti, N. Daldosso, M. Ghulinyan, D. Navarro-Urrios, M. Melchiorri, F. Riboli, M. Saiani, F. Sbrana, L. Pavesi	2006	Nanostructured Silicon for Photonics - from materials to devices	*Materials Science Foundations*	Vol. 27-28 of *(*Zuerich 2006	NO
21	N. Daldosso and L. Pavesi	2006	Low dimensional Silicon as	In Nanosilicon		YES

			a photonic material	(Elsevier, 2006)		
22	Lorenzo Pavesi	2006	Optical Gain in Silicon and the Quest for a Silicon Injection Laser	In *Optical interconnects*, Optical series	(Springer Verlag, Berlin 2006) pag. 15-32	YES
23	Pavesi L	APR 2005	Silicon chips light up	PHYSICS WORLD	18 (4): 25-26	NO
24	S. Prezioso, Z. Gaburro, L. Pavesi, A.Lui, L. Vanzetti, M. Barozzi, M. Bersani,C. Kompocholis, G. Pucker, P. Bellutti	2006	Si-nc based MOS-LED: Correlation between Structural Properties of the Active Layer and Electro-Optical Characteristics		Submitted to Physica E	YES
25	L. Pavesi	2006	Silicon light emitters and amplifiers: state of the art	Proceedings of SPIE	vol. 6125, 612508 (2006).	YES
26	Elena Froner, Roberta Adamo, Zeno Gaburro, Benno Margesin, Lorenzo Pavesi, Adelio Rigo, Marina Scarpa	2006	Luminescence of porous silicon derived nanocrystals dispersed in water: dependence on initial porous silicon oxidation	Journal of Nanoparticle Research	Vol.8, 1071-1074 (December 2006).	NO
27	N. Daldosso, G. Das, S. Larcheri, G. Mariotto, G. Dalba, L. Pavesi, A. Irrera, F. Priolo, F. Iacona, F. Rocca	2007	Study of silicon nanocrystal formation in annealed silicon-rich silicon oxide films prepared by plasma enhanced chemical vapour deposition	Journal of Applied Physics	Vol. 101, 113510 (june 2007)	YES
28	S. Hernández, P. Pellegrino, A. Martínez, Y. Lebour and B. Garrido, R. Spano, M. Cazzanelli, N. Daldosso, L. Pavesi, E. Jordana and J. M. Fedeli	2007	Linear and non-linear optical properties of Si-nc/SiO_2 deposited by PECVD	Journal of Applied Physics	submitted	NO
29	D. I. Tetelbaum, O.N. Gorshkov, A.V. Ershov, A.P. Kasatkin, V.A. Kamin, A.N. Mikhaylov, A.I. Belov, D.M. Gaponova, L. Pavesi, L. Ferraioli	July, 2005	Influence of the nature of oxide matrix on the photoluminescence spectrum of ion-synthesized silicon nanostructures	Thin Solid Films	515, 333-337 (2006).	YES
30	N. Daldosso and L. Pavesi	2007	Low dimensional Silicon as a photonic material	edited by Vijay Kumar (Elsevier)	P 372	YES
31	Lorenzo Pavesi	2007	Photonics applications of nano-silicon	edited by P.K. Choudhury and Onkar N. Singh Nova Science Publishers, Inc	p.97-124	YES
NUMBER OF PAPER WITH SEMINANO ACKNOWLEDGMENT (UNITN)						13