

# Abstracta

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Jun-97



Trabalhos Aceitos para Publicação

A026-97 à A037-97

Trabalhos Aceitos para Apresentação em Conferências

C007-97 à C011-97

**[A026.97] "A Simple Technology to Improve Crystalline Silicon Solar Cell Efficiency"**

F. C. Marques, J. Urdanivia, I. Chambouleyron

The manufacturing of high efficiency crystalline silicon (c-Si) solar cells involves advanced technologies and sophisticated equipment not available in Third World country laboratories. This paper shows that conversion efficiencies in the 15% - 16% range can be achieved with a simple laboratory process. The main steps, which only require the use of analytic grade chemicals, are: a) diffusion of a phosphorus-doped emitter layer on a textured surface; b) deposition of narrow top metal contacts using a photolithography process; c) Al alloyed back surface field, and d) a chemically sprayed tin dioxide antireflective coating.

**Solar Energy Materials and Solar Cells 52, (3-4), 285-292, 1998****[A027.97] "Atomic Transitions for Ar VII Spectrum in the Vacuum Ultra violet (VUV)"**

A. G. Trigueiros, A. J. Mania, M. Gallardo, J. G. Reyna Almandos

Two different spectroscopy light sources were used to observe the spectrum of six times ionized argon, Ar VII, in the vacuum ultra violet range, 300 - 1100 Å. 58 transitions have been identified as combinations between levels of the  $2p^6(3s^2+3p^2+3s3d)$  and  $2p^6(3s3p+3p3d+3s4p)$  configurations. For 44 of these transitions the classification is new. 29 levels have been determined belonging to these configurations where 14 of these are new. The energy parameters were obtained using Hartree-Fock relativistic calculations. The energy levels of the configurations are interpreted by fitting the theoretical energy expressions to the experimental levels using least-squares approach. Isoelectronic comparisons along the Mg I sequence have been used to support the experimental results.

**Journal of the Optical Society of America B-Optical Physics 14 (10), 2463-2468, 1997****[A028.97] "The Vacuum Ultra Violet (VUV) Spectrum of Six Times Ionized Xenon, Xe VII"**

G. H. Cavalcanti, F. Bredice, R. Hutton, F. R. T. Luna, H. Sobral, M. Wang, A. G. Trigueiros

The theta-pinch spectrum of six times ionized xenon, Xe VII, has been recorded in the vacuum ultra violet (VUV) region of 300 - 1300 Å. 27 new transitions have been identified as combinations between levels of the  $5p^2-5p5d$  and  $5s5d-5p5d$  transition arrays. From these transitions 11 new levels have been determined. The energy level assignments have been interpreted by fitting the theoretical energy level values using a least-squares approach. Hartree-Fock calculations with relativistic corrections were used to predict energy levels and transitions.

**Journal of the Optical Society of America B-Optical Physics 14 (10), 2459-2462, 1997****[A029.97] "Proof of the Identity Between Ampère and Grassmann's Force"**

M. Bueno, A. K. T. Assis

We consider a poloidal current flowing over the surface of a conducting cylinder of length  $l$  and radius  $a$ . We calculate exactly the force on a surface current element belonging to this cylinder due to the remainder of the circuit with Ampère and Grassmann's expressions. We conclude that the formulae agree with one another for any value of  $l/a$ . We then generalize this result for any current element belonging to

closed surface or volumetric currents of arbitrary forms.

**Physica Scripta 56 (6), 554-559, 1997****[A030.97] "Local Order in Hydrogenated Amorphous Germanium Thin Films Studied By EXAFS"**

G. Dalba, P. Fornasini, R. Grisenti, F. Rocca, I. Chambouleyron, C. F. O. Graef

The effect of hydrogenation on the local order in amorphous germanium has been studied by EXAFS. Measurements have been carried out on sputtered a-Ge:H films with hydrogen concentrations of 0, 7, 10 and 15 at. %, as a function of temperature in the range 11-300 K. The 1st-shell EXAFS data was analyzed by the ratio method based on cumulant expansion. The asymmetric distributions reconstructed from cumulants are in very good agreement with a parametrized distribution obtained by other researchers using calculated phase shifts. For the unhydrogenated a-Ge (deposited at 2200 C) an increase of interatomic distance, (0.018 Å) at 11 K, static disorder,  $^2\text{stat} = (1.9 \pm 0.3) \times 10^{-3}$ , and thermal disorder  $E=0.28$  THz, have been found with respect to c-Ge. Both static and thermal disorder are smaller than in an evaporated sample (deposited at 1600 C) previously studied. The insertion of hydrogen in a-Ge produces a neat reduction of interatomic distance, static disorder and asymmetry of the distribution already at the lowest H concentration (7%); then it increases almost linearly with the hydrogen content. No appreciable influence of hydrogenation on thermal disorder has been detected.

**Journal of Physics: Condensed Matter 9, 5875-5888, Apr 1997****[A031.97] "Laser Crystallization and Structuring of Amorphous Germanium"**

M. Mulato, D. Toet, G. Aichmayr, P. V. Santos, I. Chambouleyron

The short-pulse laser crystallization and interference structuring of amorphous germanium films were investigated by time resolved reflection measurements and Raman spectroscopy. We demonstrate that submicrometer crystalline structures with very sharp lateral interfaces can be produced by laser interference crystallization of non-hydrogenated samples. In hydrogenated films, on the other hand, the film surface disrupts upon laser exposure leading to the formation of a free-standing crystalline membrane. The Raman spectra of laser crystallized germanium display effects of finite crystallite size and stress.

**Applied Physics Letters 70 (26), 3570-3572, 1997****[A032.97] "On the Retrieval of Particle-size Distributions from Small Angle Scattering : the influence of statistical data dispersion"**

M. Mulato, D. Tygel, I. Chambouleyron

In this work, the problem of the retrieval of the particle-size distribution of scatterers from small angle scattering experiments noisy data is addressed. Gaussian-like particle size distributions of non-interactive spheres are used as illustrative examples. A numerical corrector method, previously reported by the present authors, is used for the retrieval process. The achievable information in real space is investigated with the help of numerical experiments, the solution of which is known in advance. Cases are solved assuming three different functional dependence of noise with scattering vector, which simulate experimental conditions. The method proves to be powerful to retrieve the correct information with noisy data. The reliability of the process is established as a function of noise level and particle size.

**Journal Applied Crystallography 31 (Parte 2), Apr 1998**



**[A033.97] " The Retrieval of the optical constants and the Thickness of Thin Films from Transmission Spectra"**

I. Chambouleyron, J. M. Martínez, A. C. Moretti, M. Mulato

The present paper discusses a new method to estimate the absorption coefficient, the index of refraction, and the thickness of thin films using optical transmission data only. To solve the problem a pointwise constrained optimization approach is used. The method consists of defining a nonlinear programming problem, the unknowns of which are the coefficients to be estimated. With linear constraints that represent prior knowledge about the physical solution. The method applies to all kind of transmission spectra and does not rely on the existence of fringe patterns or transparency. Results on amorphous semiconductor thin films and gedanken films are reported. They show that the new method is highly reliable.

**Applied Optics 36 (31), 8238-8247, Nov 1997**

**[A034.97] "Physico-chemical Aspects on an Industrial Process"**

J. G. Ramos, A. R. Vasconcellos, R. Luzzi

We briefly describe a nonclassical nonlinear thermodynamic theory with statistical foundations. This statistical approach is based on a generalization to arbitrary nonequilibrium conditions of Gibbs ensemble algorithm, the so-called Nonequilibrium Statistical Operator Method, which can be considered to be encompassed within the scope of Jaynes' Predictive Statistical Physics. This emerging formalism is used to provide a study of the techno-industrial process of thermal stereolithography (or infrared-laser-induced rapid prototyping). The experimental results are interpreted and the technical requirements fundamental for the success of the process are pointed out.

**International Journal of Quantum Chemistry 65 (3), 277-285, 1997**

**[A035.97] "Electronic Structure at InP-Organic Layer Interfaces"**

N. Kinrot, Y. Shapira, M. A. B. de Moraes

Organic layer/p-Inp ( 100 ) interfaces have been investigated using surface photovoltage spectroscopy ( SPS ) in conjunction with ultraviolet-visible absorption spectroscopy, time-resolved photoluminescence and X-ray photoemission spectroscopy. The organic layers were deposited from radio frequency plasmas of  $C_2H_2$  and  $Si(CH_3)_4$  mixed with  $N_2$ ,  $O_2$ ,  $SF_6$  and noble gases ( He and Ar ). Prior to deposition, the etched p-InP ( 100 ) surfaces exhibited two gap states, attributed to excess surface P and adsorbed O, denoted by states  $A_1$  and  $D_1$ , respectively. The  $A_1$  surface state is suppressed only by nitrogen-containing films. The  $D_1$  surface state is suppressed only by films containing sulfur and fluorine. The presence of films containing only C, H and O does not seem to change the original substrate SPS spectrum. A mechanism of these interfacial phenomena is suggested.

**Applied Physics Letters 70 (22), 3011-3013, 1997**

**[A036.97] "Study of Ion-Induced Secondary Photon Emission in Reactive Ion Etching Experiment"**

S. A. Moshkalyov, M. Machida, D. O. Campos

Optical emission spectroscopy with high spatial resolution was employed for the study of surface sputtering under reactive ion etching conditions in chlorine-containing gas mixtures. Secondary photon emission ( both atomic and molecular ) from the processed material was found to be strongly localized near the surface. A simple model, considering the observed features of the secondary photon emission as induced by ion sputtering of the processed surface, has been presented. This

technique can give new opportunities for insitu diagnostics and modeling of plasma-surface interaction in various plasma technologies.

**Japanese Journal of Applied Physics, Part 1, Regular Papers Short Notes & Review Papers 36 (7B), 4675-4681, 1997**

**[A037.97] "Photothermal and Electroreflectance Images of Biased Metal-Oxide-Semiconductor Field-Effect-Transistors: six different kinds of sub-surface microscopy"**

J. A. Batista, A. M. Mansanares, E. C. da Silva, D. Fournier.

Six different configurations for MOSFET reflectance microscopy are presented, each one revealing a particular contrast of the operating structure. These different images are obtained by interchanging the modulation of gate-source and drain-source potentials, as well as by varying the probe beam intensity. Three main components were identified in the signal, their relative importance depending on the experimental configuration: the electroreflectance component, the photo-injected carrier ( probe induced ) component and the bias current ( Joule effect ) component. The high ability technique to detect defects in these structure is also demonstrated.

**Journal of Applied Physics 82 (1), 423-426, 1997**

## Accepted papers for conference presentation

**[C007.97] "Erbium Luminescence in a-Si:H"**

Leandro R. Tessler, A. R. Zanatta

Erbium trivalent ions emit characteristic luminescence at 1.54  $\mu$ m when in certain solid hosts. This luminescence results from atomic-like optical transitions in the incomplete 4f level. The energy of this transition depends very little on the host characteristics because the f levels are shielded by external s and p electrons. The Er<sup>3+</sup> luminescence has been studied in an assortment of different hosts in the last few years because it corresponds to the "third window" of propagation in conventional silica optical fibers, where attenuation corresponds to its absolute minimum. Thus, electroluminescent devices based on Er<sup>3+</sup> in silicon would have an important impact on telecommunications, especially if the host would be compatible with existing microelectronics technologies. The usual approach to introduce Er<sup>3+</sup> in silicon and amorphous silicon is by ion implantation, and there is also one group reporting a-Si:Er:H by the MASD technique. In this paper we report on Er<sup>3+</sup> photoluminescence from aSi:Er:H prepared by co-sputtering from a silicon target partially covered by metallic erbium chunks. Photoluminescence was excited with one of the Ar<sup>+</sup> laser lines and detected with a Ge detector. The highest photoluminescence yield was found for samples prepared under growth conditions that produce oxygen contaminated low quality low quality aSi:H. For all the Er/Si concentrations studied (up to ~5 at %) the as-deposited samples emit 1.54  $\mu$ m photoluminescence at room temperature. Annealing can increase the luminescence intensity up to a factor 4. Annealing under an inert atmosphere has its optimum at 500° C, while under flowing oxygen the maximum occurs for 400° C. Higher annealing temperatures are detrimental, probably because of the out-diffusion of hydrogen from the films. One of the greatest advantages of the co-sputtering technique is its flexibility and possibility of preparation of samples with virtually any Er (or any other rare earth) content.

**In: ICAM 17 - 17th International Conference on Amorphous and Microcrystalline Semiconductors, Budapest, Hungary, 25-29th august, 1997**  
**Journal of Non-Crystalline Solids 227-230, Part 1, 399-402, May 1998**

**[C008.97] "Comparison Between Hexagon and Superman**

### Configurations for the Auger Observatory"

A. R. Biral, J. A. Chinellato, C. Dobrigkeit, R. C. Shellard, M. Albrow, C. O. Escobar

We compare the performances of two configurations of fluorescence detectors under discussion for the Auger Project, with equivalent optical elements but different geometries. From the results of simulating the attenuation of light in the atmosphere for both cases, the Hexagon configuration gains an advantage over the so-called Superman configuration, having a relative higher efficiency in detecting showers.

In: **Proceedings of the 25th International Cosmic Ray Conference, Durban, Africa do Sul, v. 7, 369-372, 28 de Julho a 8 de Agosto de 1997, accepted on may 1997**

### [C009.97] "Tunable and High Bit Rate Erbium-Doped Fiber Ring Soliton Source"

C. Mazzali, H. L. Fragnito

We demonstrate a tunable fiber ring laser in which an intracavity 1x2 electro-optic modulator acts as harmonic mode-locker and adjustable output coupler. With an Erbium doped fiber as the gain medium we generate laser pulses at 2.4 GHz, tunable between 1530 and 1565 nm, and FWHM of 3.4 ps.

In: **OSA -Optical Amplifiers and Their Applications Topical Meeting, Fiber and Active Wavelengths (FAW), Victoria, B.C., Canada, 21-23 July, 1997**

### [C010.97] "Recirculating Loop for Experimental Modeling of Long Haul Communications Systems"

C. Mazzali, L. Fragnito

We demonstrate an optical fiber recirculating loop for test of optical communications systems and devices. The proposed configuration employ sections of dispersion shifted fibers, standard fiber, and a set of in-line devices, such as tuning filters, optical amplifiers, polarization controllers, etc. Propagation over more than 1400 km was observed and the main results presented here are related to the observation of the effects due to the slow dynamics of optical amplifiers and also to the possibility to simulate extra lengths of fiber with an attenuator.

In: **International Microwave and Optoelectronics Conference SBMO/IEEE MTT-S, 1997, Linking to the Next Century, Proceedings, vol. 2, 447-452, 11-14 Aug 1997**

### [C011.97] "Structural Properties of a-Ge<sub>1-x</sub>C<sub>x</sub>:H Alloys Prepared by the RF Sputtering Technique"

F. C. Marques, J. Vilcarromero, F. L. Freire, Jr.

Structural and mechanical properties of hydrogenated amorphous germanium carbon (a-Ge<sub>1-x</sub>C<sub>x</sub>:H) alloys are presented. The films were prepared by the rf-co-sputtering

technique using a graphite/germanium composed target. The carbon and germanium relative concentrations were determined by RBS, and the total hydrogen concentration by ERDA measurements. The optical gap only increases in a small range of carbon concentration, which goes from 0 at.% to about 15 at.%, and it tends to remain almost constant for concentrations higher than that. Infrared transmission absorption spectra show several absorption bands related to Ge-C stretching, C-Hn (n = 1,2,3) and Ge-H stretching and bending modes. The mechanical internal stress was strongly affected by the incorporation of carbon. The trends of the optical gap, refractive index, infrared absorption and mechanical stress as a function of the carbon content suggest that the high carbon concentration alloys have polymeric and/or graphite-like contribution in their structure.

In: **Proceedings of the 1977 MRS Spring Meeting, San Francisco, CA, USA, May 1997**

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