Tuesday Evening Poster Sessions, October 30, 2001

Thin Films
Room 134/135 - Session TF-TuP

Microstructure, Oxides, and Optical Properties Poster Session

TF-TuP1 MEVVA Ion-implanted Cr Interlayer on the Microstructure of CrN on Steel, *S. Han,* National Taichung Institute of Technology, R.O.C.*; J.-H. Lin,* National Tsing Hua University, Taiwan, ROC*; Z.C. Chang,* National Chin-Yi Institute of Technology, R.O.C.*; C.J. Yang, F.-S. Shieu,* National Chung Hsing University, R.O.C.*;* ***H.C. Shih,*** National Tsing Hua University, R.O.C., TAIWAN

The effect of MEVVA ion-implantation of Cr on the microstructure and properties of CrN coatings on the steel were investigated in this paper. Two types of CrN-coated specimens (CrN/steel and CrN/Cr/steel) by cathodic arc plasmas deposition were prepared with and without an interlayer deposited by MEVVA ion-implantation of Cr. And the microstructure and microchemistry of chromium nitride has been investigated by using X-ray diffraction (XRD), cross-sectional transmission electron microscopy (XTEM) and selected area diffraction (SAD). Therefore, the coatings exhibit a microcolumnar morphology. The outermost layer of the coating is identifed as CrN. Furthermore, from an estimation of the unrelaxed thermal stresses based on a bilayer model, it is demonstrated that the presence of a Cr interlayer between CrN and steel can dramatically reduced the thermal stress in the CrN coating.

TF-TuP2 Growth of Wide Band Gap MnS Thin Films by rf Sputtering: Substrate Temperature Effects on Structure and Composition, *S.A. Mayen-Hernandez, R. Perez-Castanedo,* ***O. Jiménez-Sandoval,*** *G. Torres-Delgado, S. Jiménez-Sandoval,* Cinvestav-IPN, Mexico

Manganese sulfide (MnS) is a wide band gap semiconductor that crystallizes in its stable form with the octahedrally coordinated rocksalt structure, presenting as well other metastable structures: cubic(zincblend) and hexagonal (wurtzite). One of the problems that have precluded the application of this semiconductor in devices, has been the little work carried out so far to grow high quality MnS films. To date, most of the work done on MnS has been using chemical bath and thermal evaporation as preparation thecniques. These two methods yielded amorphous and polycrystalline films, respectively. To our knowledge, no report exists so far on the growth of MnS films by rf sputtering due to the technical difficulties involved. In this work we report on the appropriate conditions for the growth of nearly stoichiometric MnS thin films prepared by rf sputtering and the important effects of substrate temperature on film composition and structure. The produced films were polycrystalline with an energy band gap of around 3.47 eV, a value that makes MnS an appealing material for optical windows in applications such as solar cells.

TF-TuP3 Structural Investigations for Amorphous Films Deposited by Simultaneous DC Sputtering of ZnO and In@sub 2@O@sub 3@ Targets, *T. Moriga,* ***A. Fukushima,*** *K. Tominaga, I. Nakabayashi,* The University of Tokushima, Japan

Oxide films in the ZnO-In@sub 2@O@sub 3@ system were deposited by simultaneous dc sputtering of ZnO and In@sub 2@O@sub 3@ facing targets at the substrate temperature of 150°C. The ratio @delta@ of the ZnO target current to the sum of both the currents was varied. In the @delta@ range from about 0.20 up to 0.67, an amorphous film with one broad diffraction peak at around 2@theta@=33° could be deposited. At the higher substrate temperature of 300°C, the crystallized films with the homologous Zn@sub k@In@sub 2@O@sub k+3@ structure (k=2 for @delta@=0.50, k=3 for @delta@=0.57, and k=5 for @delta@=0.67) were deposited in the range from 0.50 to 0.67, and the bixbyite-type In@sub 2@O@sub 3@ phase was observed in the @delta@ range of 0=<@delta@<0.50. We analyzed the peak position of the amorphous films. For example, we took the amorphous film with @delta@=0.50. The broad peak lies in the center of two peaks. One was the (008) peak which appears strongly in the homologous Zn@sub 2@In@sub 2@O@sub 5@ films. The other was the (104) peak which appears strongly in the bulk Zn@sub 2@In@sub 2@O@sub 5@. The amorphous film with @delta@=0.50 had the atomic ratio of Zn:In=1:1. These facts imply that the amorphous film with @delta@=0.50 would be comprised of NOT-ordered Zn@sub 2@In@sub 2@O@sub 5@ matrix. We will discuss a possibility of existence of ZnIn@sub 2@O@sub 4@ (k=1 in Zn@sub k@In@sub 2@O@sub k+3@), by applying this kind of concept to an amorphous films with @delta@=0.33. The @delta@-value dependence of electrical properties (resistivity, carrier concentration and Hall mobility) suggest the existence of ZnIn@sub 2@O@sub 4@.

TF-TuP5 Micro-crystallites in Mo/Si Multilayer EUV Coatings, ***E. Louis,*** *I.J. Wever, A.E. Yakshin, F. Bijkerk,* FOM-Rijnhuizen, The Netherlands*; J. Verhoeven,* FOM-Amolf, The Netherlands*; E. Ziegler,* European Synchrotron Radiation Facility, France

The reflectivity of 13.5 nm radiation by a Mo/Si multilayer system (periodicity 6.7 nm) depends strongly on the interface roughness and the thickness of the interfacial molybdenum-silicide layers. Ideally, the structure of the constituent layers of these Mo/Si coatings is amorphous. In this work we show results of X-ray diffraction experiments that clearly show the presence of small crystallites in the Mo layers, and, depending on the process parameters during the deposition of the layers, in the molybdenum-silicide interlayers. By varying the incident angle and the energy, we were able to observe a preferential orientation of the crystallites. The crystal orientation was found to depend on the various process conditions during the deposition of the layers and ion beam smoothening of the interfaces. We also observed indications of stress in the Mo-crystallites. The results were obtained using Cu-K radiation in an in-house diffractometer (Philips MRD) as well as 16 keV photons at beam line BM5 at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France.

TF-TuP6 Fabrication of Perforated Thin Films with Helical and Chevron Pore Shapes, ***K.D. Harris,*** *M.J. Brett,* University of Alberta, Canada

We will present a simple method for the fabrication of thin films or membranes perforated by helical and chevron shaped pores. Using the glancing angle deposition (GLAD) evaporation technique highly porous (40-50% of bulk density) SiO@sub 2@ thin films of helical and chevron microstructure were deposited on Si substrates. Typical thin films have thicknesses on the order of 2µm and are composed of 1 to 20 turns. The thin films produced by this technique were filled with photoresist and, subsequently, etched to remove the helices, leaving a continuous photoresist cast of the original film. It has been found possible to produce these perforated photoresist films from microstructures distributed either randomly over the substrate, or from structures grown on well defined, periodic arrays of micrometer or sub-micrometer spacings. The perforations have been produced in both chevron and helical shapes, and both photoresist and spin-on-glasses have been successfully used to fill the template. In addition, it has been found possible to electroplate back up through the perforated thin film, reproducing the structure of the original template with an alternate material. The fabrication processes will be discussed along with the results of optical and magnetic characterization of the films.

TF-TuP7 Influence of the Deposition Conditions on the Growth and Structure of Fe Films on Cu(001), ***S.K. Clowes,*** *L.V. Goncharova, B.J. Hinch,* Rutgers University

We have undertaken an in-depth study into the growth and structure of Fe/Cu(001) films using helium atom scattering, AES and SPA-LEED. This is a system which has been extensively studied during the last two decades, but which has produced a number of contradictory conclusions for the growth mode of the Fe films. This study has paid particular attention to the effects that the specific conditions during deposition have on the growth and quality of the films. These include the rate-of-deposition, surface defects, substrate temperature and contaminants such as oxygen. It is known that oxygen allows the formation of a single, well ordered, monolayer by reducing the surface free energy when it is adsorbed in the fcc hollow site. In a similar manner, it is suggested that under certain conditions oxygen can behave as a surfactant during the deposition of thicker films, promoting layer-by-layer/bilayer growth.

TF-TuP8 Engineering of Porous Thin Films by Modification of Substrate Topography, ***B. Dick,*** *D. Vick,* University of Alberta, Canada*; T. Smy,* Carleton University, Canada*; M.J. Brett,* University of Alberta, Canada

A unique class of evaporated porous thin films has been developed using the technique of glancing angle deposition (GLAD). High porosity in the films is achieved by in situ control of the substrate orientation during deposition. At sub-micron scale lengths, the structure of the films consists of a "forest" of isolated columns that can be engineered into a variety of shapes. For certain envisioned applications, a regular arrangement of uniformly shaped columns may be desirable. Previous work suggests that these requirements may be difficult to achieve on planar substrates due to the column competition, extinction and thickening that occurs during growth of the film. These related phenomena arise from the fact that the

advancement of the film - vacuum interface is an inherently non-linear process in which the self-shadowing mechanism plays a predominant role. We are currently investigating the degree to which order may be imposed on the film growth by means pre-patterned substrate topography. Using lithographic and embossing techniques, substrates with patterned seed arrays have been created, onto which GLAD films are then deposited. The elevated seeds serve as nucleation sites for the columns by exploiting the self-shadowing mechanism. After deposition, the films can be analyzed using atomic force and scanning electron imaging, with the dual aim of determining scaling behaviour and identifying appropriate choices of substrate and deposition parameters to produce stable column growth. Results from an experimental study supplemented by 3D-FILMS ballistic simulations will be presented. Recent examples of metal and oxide films deposited by electron beam evaporation and sputtering onto patterned and planar topography will be shown, together with a summary of our present understanding of the growth behaviour of GLAD films.

TF-TuP9 Composite Tantalum Nitride-Silicon Nitride Thin Films for 193nm Embedded Attenuated Phase Shift Masks, ***M.G. Lassiter***, *M. Cangemi,* Photronics Corporation*; P.D. Rack, B.W. Smith,* Rochester Institute of Technology

As semiconductor device dimensions continually decrease in size, the ability to print these dimensions using 248nm light from a KrF excimer laser is becoming increasingly more difficult. According to Lord Rayleigh's resolution criteria the minimum resolution on the wafer is proportional the exposure wavelength divided by the numerical aperture of the objective lens. Thus resolution can be improved by using smaller wavelengths, which has brought about the development of exposure systems that use the 193nm ArF excimer laser. The use of a new exposure wavelength requires the development of new materials for the photomasks used in such an imaging system. Image contrast has been significantly improved in the past due to the use of embedded attenuated phase shift masks (EAPSM). An EAPSM induces a 180-degree phase shift and limited transmission in the regions that are traditionally opaque in a binary mask. The result is a phase induced contrast enhancement at image edges at the expense of higher background intensity compared to a binary mask. New materials are needed to construct such a mask for 193nm wavelength. This paper explores the use of a composite TaN-Si3N4 for the purpose of providing both the radiation attenuation and the relative phase shift on an EAPSM for use at 193nm wavelength. The TaN and Si3N4 were each reactively rf sputter deposited and their respective optical constant spectra were determined using a Woollam VUV-Variable Angle Spectroscopic Ellipsometer. An effective media approximation (EMA) was used to combine the constituents to tune the optical properties to the desired values for an EAPSM film. Finally, a matrix of composite thin films of varying the TaN-Si3N4 composition were co-deposited and the optical constants of the composites were determined using the ellipsometer to verify the EMA. The composition was iteratively tuned to provide the optimum optical constants at 193nm for a 20% transmission EAPSM.

TF-TuP10 Electrical, Optical and Structural Properties of Sol-gel Deposited Tantalum Oxide Thin Films, ***M.J. Alam***, *D.C. Cameron,* Dublin City University, Ireland*; M.S.J. Hashmi,* Dublin City University

Because of its wide field of applications in semiconductor sciences, tantalum oxide (Ta@sub2@O@sub5@) has been extensively studied both experimentally and theoretically over the past three decades. Tantalum oxide films are of considerable interest in optical and optoelectronic technology. Tantalum oxide film is a promising candidate as a capacitor dielectric in high-density dynamic random-access memories (DRAMs) and in ultra-large-scale integrated devices (ULSI) due to its high dielectric constant (about 25) compared with that of only 3.9 for SiO@sub2@. @paragraph@ To date, tantalum oxide films have been deposited using a variety of deposition techniques, such as, thermal oxidation, electron beam evaporation, reactive evaporation, reactive sputtering, pulsed laser deposition and chemical vapor deposition, as well as the sol-gel method. Recently, the preparation of tantalum oxide films by a sol-gel process has received increased attention. This technique has many advantages, such as low temperature processing, simple and compact equipment, deposition on a substrate of large area and a complex structure and high homogeneity of the deposited films. @paragraph@ Thin homogeneous tantalum oxide films have been prepared on silicon and glass substrates using a sol-gel process. The coating solutions were prepared using Ta(OC@sub2@H@sub5@)@sub5@ as a precursor. X-ray diffraction studies determined that the sol-gel films, annealed at temperatures below 400°C were amorphous. Films annealed at higher temperatures were crystalline with the hexagonal structure. X-ray photoelectron spectroscopy was employed to examine the elemental content during the process. Ellipsometry, Fourier transform infrared spectroscopy, capacitance-voltage and current-voltage measurements were also employed to characterize the tantalum oxide films annealed at different temperature in different atmospheres.

TF-TuP11 Infrared Emission from Electroluminescent Thin Film ZnS Doped with Rare Earth Fluorides, ***W. Glass***, *A.S. Kale, R. Owing, M.R. Davidson, P.H. Holloway,* University of Florida

Alternating current thin film electroluminescent devices (ACTFELDs) are well-known thin film structures used for flat panel displays. A well-known phosphor for such displays is ZnS doped with either transition or rare earth elements. For example, ZnS:TmF@sub 3@ emits blue light, ZnS:NdF@sub 3@ emits orange, ZnS:DyF@sub 3@ emits yellow, and ZnS:ErF@sub 3@ emits green. Each of these materials also emits in the infrared. The infrared emission from these types of materials is often overlooked except in the case of ErF@sub 3@, which has been of interest for fiber optic communications. The infrared intensity of these materials is dependent on the environment of the luminescent centers and can be improved by modification of deposition and processing. In this study, rare earth fluoride doped ZnS films were deposited by RF planar magnetron sputter deposition or thermal evaporation. Deposition temperature and annealing conditions are varied to determine temperature effects during and after deposition. In addition, the rare earth concentration was changed from a maximum of 1.6 mol% to zero by simultaneously sputtering an undoped ZnS target. The devices were then excited by electroluminescence to determine the effects of the deposition variations. These sputtered devices will be compared to those deposited by evaporation. Finally, emission from materials with similar and dissimilar luminescent decay paths will be discussed.

TF-TuP12 Aluminum Flakes with Enhanced Spectral Properties, ***K.E. Coulter***, *R.W. Phillips,* Flex Products, Inc.*; T. Mayer,* Optical Coating Laboratory, Inc.*; R.A. Bradley, J.S. Matteucci,* Flex Products, Inc.

A vacuum deposited multi-layer rigid and brittle bright metal flake has been developed that provides favorable planar specular reflective characteristics in the visible wavelength range and application and durability advantages. Two constructs of the 300nm thick by 15micron in diameter brittle flakes have been demonstrated. One design has a central layer of reflective material supported on both sides by dielectric layers at a thickness of 10-100nm. The addition of the dielectric layers theoretically reduces the specular reflectance of the aluminum surface but the addition a dielectric for support increases reflectance 5-10% in the flake form. The second design utilizes the same materials and dimensions but has the dielectric as the central layer with the reflective material on each side. The result for both designs is a sub-micron thick three-layered metal flake that exhibits a uniaxial compressive strength of approximately 8 times a corresponding uniaxial tensile strength. As a result, the metal flake is then afforded the benefits of rigidity and brittle fracture during manufacturing and application processing. In this talk, a review of design, vacuum deposition processes for manufacture, characterization and use of the flakes in applications will be discussed.

TF-TuP13 The Effect of Annealing upon IR Electroluminescent Emission For Zinc Sulphide: Rare Earth Doped Thin Films, ***A.S. Kale***, *W. Glass, R. Owings, M.R. Davidson, P.H. Holloway,* University of Florida

Infrared emitters (IR) enjoy a wide market today with a variety of applications ranging from commercial based fiber optic communication devices to remote controls for televisions. ZnS doped rare earth fluoride thin films typically 1μm thick have been fabricated by RF sputter deposition in the conventional metal-insulator-semiconductor-insulator-metal configuration to study a new structure for IR radiation. The current study investigates three different kinds of phosphors namely ZnS:TmF@sub3@, ZnS:NdF@sub3@ and ZnS:ErF@sub3@ for their IR versus visible emission. Electroluminescence has been investigated after different annealing conditions (as-deposited to 650°C) and time (5-60min), to study the effect on emission properties. As annealing improves the crystallinity of the film, the emission improves. The brightness versus concentration of dopant has been measured and optimized. Emission spectra of the devices have been measured from 0.35 to 1.5μm and the films studied for their emission efficiency and decay time. Methods of enhancing the IR output with respect to the visible have also been studied and reported, including codoping and condition of annealing.

TF-TuP14 Fabrication and Optical Properties of SiO@sub 2@ Sol-gel Made Thin Films Modified with Carminic Acid, *L.L. Diaz-Flores,* Instituto Tecnolodico de Saltillo, Mexico*; G. Luna-Barcenas, J. Gonzalez-Hernandez,* ***Yu.V. Vorobiev,*** Unidad Queretaro del CINVESTAV-IPN, Mexico

SiO@sub 2@ sol-gel colored films on the glass slides were prepared by traditional process, using the precursor solution made of water, TEOS and ethanol, with the ratio of the components providing good structural quality of the films, and using the dip-coating apparatus. The carminic acid was introduced in the solution; special mechanical treatment of the solution was made to ensure good dispersion of the colorant. The films with intense and stable red color were obtained. The optical absorption spectra of the films contain all three visible absorption bands mentioned in the literature (494, 520 and 555 nm) as well as the UV band at 330 nm not reported earlier. The quantum mechanical description of energy spectrum of the system was attempted based on the modified FEMO approach, treating the carminic acid molecules as three-dimensional quantum wells and using the Born-von Carman boundary conditions corresponding to the mirror reflection of an electron delocalized inside the molecule, from its walls. Good agreement between the theory and experiment was obtained without any adjustable parameters.

TF-TuP15 Inhomogeneous Optical Thin Films and Filters Based on SiN@sub x@:H Prepared by PECVD in Dual-mode Microwave/Radiofrequency Plasma, ***R. Vernhes***, *O. Zabeida, J.E. Klemberg-Sapieha, L. Martinu,* Ecole Polytechnique of Montreal, Canada

Deposition of inhomogeneous thin films for optical applications offers great advantages in comparison to traditional multilayer structures. Particularly, optical losses and mechanical stresses due to interfaces are considerably reduced, as well as harmonics and side lobes are eliminated from transmission or reflection spectra. In the present work, we used plasma-enhanced chemical vapor deposition (PECVD) to grow amorphous hydrogenated silicon nitride (SiN@sub x@:H) films on glass and silicon substrates using silane and nitrogen. Control of the refractive index was performed by selectively varying the power of microwave and radiofrequency sources without any change in gas composition. In this way, the film properties are strictly controlled by the energetic interactions in the gas phase and at the exposed surface. The films were characterized by spectrophotometry, variable angle spectroscopic ellipsometry, Fourrier transform infrared spectroscopy, and elastic recoil detection in time-of-flight regime. We found that the radiofrequency mode permits one to obtain a higher refractive index, while the microwave mode leads to a lower refractive index. We demonstrated that this variation was related to a change in composition and density. Indeed, films deposited by radiofrequency mode contain larger quantities of Si-H groups and show a denser microstructure while films grown by microwave mode present a higher concentration of N-H groups with a porous microstructure. We proved that it is possible to pass continuously from one composition and structure to another by gradually adjusting the power of each source. This leads to a continuous variation of refractive index from 1.65 to 1.95. Using this refractive index interval, we demonstrate the fabrication of optical filters with an inhomogeneous refractive index depth profile. Optical and mechanical properties of such filters are discussed.

TF-TuP17 Deposition of Transparent Conductive TiN Oxide Thin Films Doped with Fluorine by PACVD, *F. Arefi-Khonsari,* ENCSP-University of P.M. Curie, France*;* ***N. Bauduin***, *J. Amouroux,* ENSCP-University of P.M. Curie, France

The conductivity of plasma deposited tin oxide films from a mixture of O@sub2@/Ar/Tetramethyltin (TMT) can be enhanced from 0.01 to 100 @ohm@@super@ -1.cm-1 by biasing the substrate by means of a second generator. In this work an attempt has been made to dope the films by a one step process by introducing a fluorine precursor which was SF6 with the plasma mixture used for the deposition of tin oxide films. Optical emission spectroscopy and mass spectrometry were used to study the plasma phase and the characterization of the films was carried out by different surface diagnostic techniques such as SEM, XPS and FTIR. A two fold increase of the electrical conductivity was obtained for very small flow rates of SF6 introduced in the discharge.For higher flow rates, a sharp decrease of the conductivity was obtained. For high flow rates of SF6, competitive etching and functionalization processes assisted by fluorine atoms present in the discharge took place. Although the conductivity dropped down, the optical transmission of the deposited films remained higher than 90%.Moreover, the morphology of the films was modified by the presence of SF6 with an increase of the grain size and the appearance of clusters on the surface of the films.

TF-TuP18 Development of a New Luminescence Spectrum from ZnS:Mn Films, *T. Hirate, N. Orihara,* ***T. Satoh,*** Kanagawa University, Japan

ZnS Films with a new electroluminescence and photoluminescence spectrum were prepared by the modified chemical vapor deposition method developed by us. The deposition method is a low pressure thermal CVD system basically concerning the synthesis of ZnS matrix except that the metal Mn target is set in the deposition chamber. The two main precursors used to synthesize the ZnS are the metal Zn vapor and H2S. The pulsed Nd:YAG laser beam (wavelength =1.064μm) was used to ablate the Mn target and to dope Mn into the growing ZnS film. The crystal structure of the deposited ZnS:Mn films was analyzed by XRD and the composition was analyzed by EDX and by XPS. The crystallinity of the films was generally poor and it was proven that the deposited ZnS:Mn films consisted only of Zn, S and Mn within the limits of detection by the EDX and XPS analysis. The electroluminescence (EL) spectrum of the ZnS:Mn films hitherto reported has a peak at about 5850Å and the photoluminescence (PL) spectrum has also the main peak at the same wavelength. On the other hand, the EL spectrum of this study has a new peak at 6700Å other than the peak at 5850Å, and the PL spectrum has a strong and wide peak at 7000Å and the intensity at 5850Å is very weak. It was experimentally confirmed that the appearance of these spectra is not due to the concentration of Mn and not due to the interference. We discovered these new spectra and the discrepancy between EL and PL spectrum for the first time. We consider that these may be due to any excited state of Mn generated by the high laser energy density, and that this deposition method has a high probability of development of a new spectrum.

TF-TuP19 Growing Behavior and Luminous Characteristics of ZnGa@sub 2@O@sub 4@ Thin Film Affected by the Substrates and Heat Treatment, *Y.J. Kim,* ***S.M. Jeong,*** Kyonggi University, Korea*; Y.E. Lee,* ETRI, Korea

ZnGa@sub 2@O@sub 4@:Mn phosphor powder has been well known for the green luminescence for flat panel displays because of its good chemical stability and excellent luminescent properties. However, thin film type ZnGa@sub 2@O@sub 4@:Mn has a limitation in a practical application due to its low luminous properties. In this work, the dependence of growth behaviors and luminous properties on the various substrates and heat treatment were examined. Amorphous, polycrystalline, and highly preferred oriented ZnO thin films were prepared by rf magnetron sputtering method on ITO coated glass substrates to investigate the effects of substrates. Thin film phosphors were deposited on these various substrates, and the structural, luminescent, and optical properties were characterized. It will be emphasized that the structural and luminescent properties of ZnGa@sub 2@O@sub 4@:Mn thin-film phosphors are significantly influenced by the crystallinity of the ZnO layers. On (002) highly oriented ZnO thin film, well developed crystalline ZnGa@sub 2@O@sub 4@thin film could be obtained and showed high luminescent intensity as well. Structural relations between wurzite ZnO film and spinel ZnGa@sub 2@O@sub 4@ film were also investigated to determine the growth mechanism of ZnGa@sub 2@O@sub 4@films. By heat treatment, luminous properties were improved and depended on annealing conditions such as temperature and atmosphere. Defects in as-deposited films which deteriorated the luminous properties could be annihilated by defect transportation and solid state reaction during annealing process.

TF-TuP20 Optical Absorption in the Visible and Near Infrared Range of Electron-beam Deposited Metal-dielectric Structures, ***F. Sabary***, *A. de Winne, P. Hamel,* CEA Le Ripault, France

Metal-dielectric structures were deposited by electron beam evaporation. They consist in a silver island film separated from a smooth silver surface by a dielectric material. These structures exhibit strong optical absorptions in the visible range. The spectral position and the amplitude of these absorptions can be modified by changing the mass thickness of the silver island film, the thickness of the dielectric layer and by performing a post-deposition annealing. With appropriate experimental parameters, quasi-total extinction can be obtained. More complex structures have been fabricated by sequential deposition of silver island films and dielectric layers. These structures exhibit a large band absorption in the visible and near infrared range. A theoretical calculation was carried out, based on an effective medium model taking into account the interactions between the silver islands and the metallic substrate.

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