C O N T E N T S

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NUCLEAR PHYSICS

The development of the density and temperature inhomogeneities arising in collision of heavy-ions is investigated on the basis of Landau Fermi liquid theory. We discuss the mechanism of nuclear fragmentation as a result of these inhomogeneities. Comparison is made with the earlier works carried out by using various types of interaction functions.

NUCLEAR PHYSICS - NUCLEAR REACTORS

A fuel rod from the core of the HELEN Subcritical Assembly was measured by gamma-ray spectrometry. The efficiency calibration was achieved using the GESPECOR Monte Carlo simulation package. No evidence of the presence of fission products was found in the spectra. The detection limit for ^{137}Cs was better than 1.5 Bq g^{-1}.

PLASMA PHYSICS

The cathodic sputtering process in the regime: normal discharge (ND) – abnormal discharge (AD) is not described by the same laws as the ND or AD processes. The deviation from the "cos θ" law, established by P. Sigmund [1] and M. W. Thomson [21] is put into evidence for the sputtering in stationary ND regimes. The deviation is analysed by applying a radio frequency (RF) field, inductively coupled to the discharge cathode. The electric field distribution was measured with a double probe.

The main cause of the changing in the sputtering process, in the ND-AD transition regime, is the modification of the electric field distribution and, respectively, of the space charge.

CONDENSED MATTER

Foils of $YBa_2Cu_3O_{7-x}$-superconductor in polytetrafluorethylene (PTFE) were obtained by pressing and sintering powder of PTFE and superconductors (95÷55 wt. % superconductor). X-ray diffraction revealed the presence of the orthorhombic phase of $YBa_2Cu_3O_{7-x}$. In some cases a decomposition of the superconducting cuprate was observed. Magnetic susceptibility indicates an onset critical temperature of 90.8 K but with wide transition. The fine structure of $\chi(T)$ curves indicates the presence of other phases of lower critical temperature. Owing to their mechanical properties these foils seem promising for flexible magnetic screens at low temperatures.

Some effects of rare-earth ions on the properties of polycrystalline stoichiometric ferrite with formula $Cu_{0.3}Mg_{0.2}Zn_{0.5}Fe_2O_4$ are discussed. The results obtained reveal that the doping of a small amount of rare-earth oxide (2% weight) in spinel ferrite can affect both structure and physical properties.

In this work the influence of the CuO and PbO on the densification of the MgZn ferrite for various sintering temperatures between 800 and 1100°C was investigated. By Cu substitution for Mg in $Mg_{0.5-x}Cu_xZn_{0.5}Fe_2O_4$ ferrite ($x = 0; 0.1 ; 0.2; 0.3; 0.4; 0.5$) an increase in the density was obtained at relatively low firing temperature.

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TiO_2 thin films were obtained onto unheated glass substrates by a *d.c.* magnetron sputtering method. X-ray diffraction (XRD) patterns showed that the as-deposited films exhibit an amorphous structure. The structure changes to a mixed one, anatase (50%)/rutile (50%), after a heat treatment in air for 2 h in the temperature range 300-673 K. Using ellipsometric measurements and solving with computer the corresponding equations, a modelling technique was elaborated for finding the optical constants of the TiO_2 thin films deposited on substrates with given optical constants. The observed increase in the refractive index and extinction coefficient correlates well with the observed structure changes. A sensitivity analysis was performed.

TiO_2 thin films, obtained by *r.f.* sputtering method, were deposited onto glass substrates. Undoped TiO_2 films crystallize in a mixed anatase/rutile phase at a substrate temperature of 250°C. The films structure changes by adding cerium impurities, anatase phase being the only one detected. Consequently, the transmittance and optical constants are also modified. Phase and surface morphology were investigated using X-ray diffraction (XRD) and scanning electron microscopy (SEM). The spectral dependency of the refractive index and the extinction coefficient have been determined in the wavelength range between 360 and 830 nm using variable angle spectroscopic ellipsometry (VASE).

This synthesis work, based on the authors' theoretical and practical considerations, presents the physical, chemical and thermodynamical process parameters of the substrate - thin film - thermodynamic system and its influence about the parameters for qualities characterisation of all the thin films types. The balance temperature (T_e), the internal energy of the system (*U*), the system enthalpy *(H)* and the Gibbs energy (*G*) are, after theoretical considerations of any thermodynamical system, the process parameters, therefore for system substrate-thin film too. For chemical processes, that are complementary processes of the vacuum thin films deposition by PVD methods, it must be also used the chemical potential (*μ*) of the thin film constituent substances. These physical, chemical and thermodynamical parameters are also presented and used in many Growth Theories of the vacuum deposition thin films. Besides these parameters the features of the thin films, deposited by PVD methods [4], are also influenced and determined and by the deposition technological parameters, kept as manufacturing secrets and protected by patents. In the second part of the work it is presented a synthesis of the qualities characterisation parameters for the thin films and also the practical consideration, based on the authors technological experiments about the most important process parameters, presented above. So, in this work are also presented experimental results about the structure, the adhesion and adhesion of the metallic anticorrosion thin films on the steel sheets.

GEOPHYSICS

The first part of this paper contains the results of an attempt to estimate the electromagnetic impedance in the zone of Vrancea deep seismic foci using electromagnetic data obtained at Muntele Roşu Observatory.
The second part presents a tentative basic approach to separating the two different categories of natural electromagnetic events caused by geodynamic processes and to improving the signal/noise ratio of the electromagnetic records.

The theoretical reasons for using ratios $B_Z(t)/B_X(t)$ and $B_Z(t)/B_Y(t)$ of the geomagnetic flux density components as earthquake prediction tools are first of all provided. Since the roughly EW-oriented B_Y component was negligibly small, we found that using $\zeta(t)$, the time variation of the mean daily ratio $B_Z(t)/B_X(t)$, was both right and advisable.
The paper is based on records made at Muntele Roşu Electromagnetic Observatory during the time intervals from December 1997 to September 1998 and from November 1998 to May 1999.
The results are given in Figs. 1-17. They prove the ratio $\zeta(t)$ is an effective short-term precursor factor of Vrancea seisms, as it showed precursor perturbations(anomalies) in 92% of earthquakes of magnitudes $M_{GR} \geq M_0$ ($M_0 = 3.6$-4.0, but mostly $M_0 = 3.9$) occurring during the time periods under investigation.
The precursor merit of the $\zeta(t)$ ratio has been significantly improved by determining relation (8), which makes it possible to estimate the precursor time as a function of earthquake magnitude.

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The present paper is a study of macroseismic intensity attenuation laws, using the isoseismal maps for 10 crustal earthquakes with epicentral, maximum intensity in the range V to VIII degrees (Modified Mercalli scale) and M_D between 4.2 and 5.5, that occurred in the Banat (Romania) seismic region. The attenuation was analyzed as a function of maximum intensity, distance and azimuth, from the logarithmic attenuation formula that best fits the observed data. The bulk of derived equations is intended to be further used in the assessment of the seismic hazard of Romania. For the correct assessment of seismic hazard, the interpretation of the macroseismic effects distribution from a given seismic zone, as well as the good evaluation of seismic intensity attenuation laws are very important.