Grey Literature Repositories and CRIS in a SOA Environment

Nikos Houssos

National Documentation Centre (EKT)

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Agenda

- Introduction
- Case studies of systems
  - Hellenic National Archive of Doctoral Dissertations
  - Studies / reports commissioned by government organisations
- Repositories interoperating in a SOA environment

Introduction

- Nikos Houssos
- nhoussos AT ekt.gr

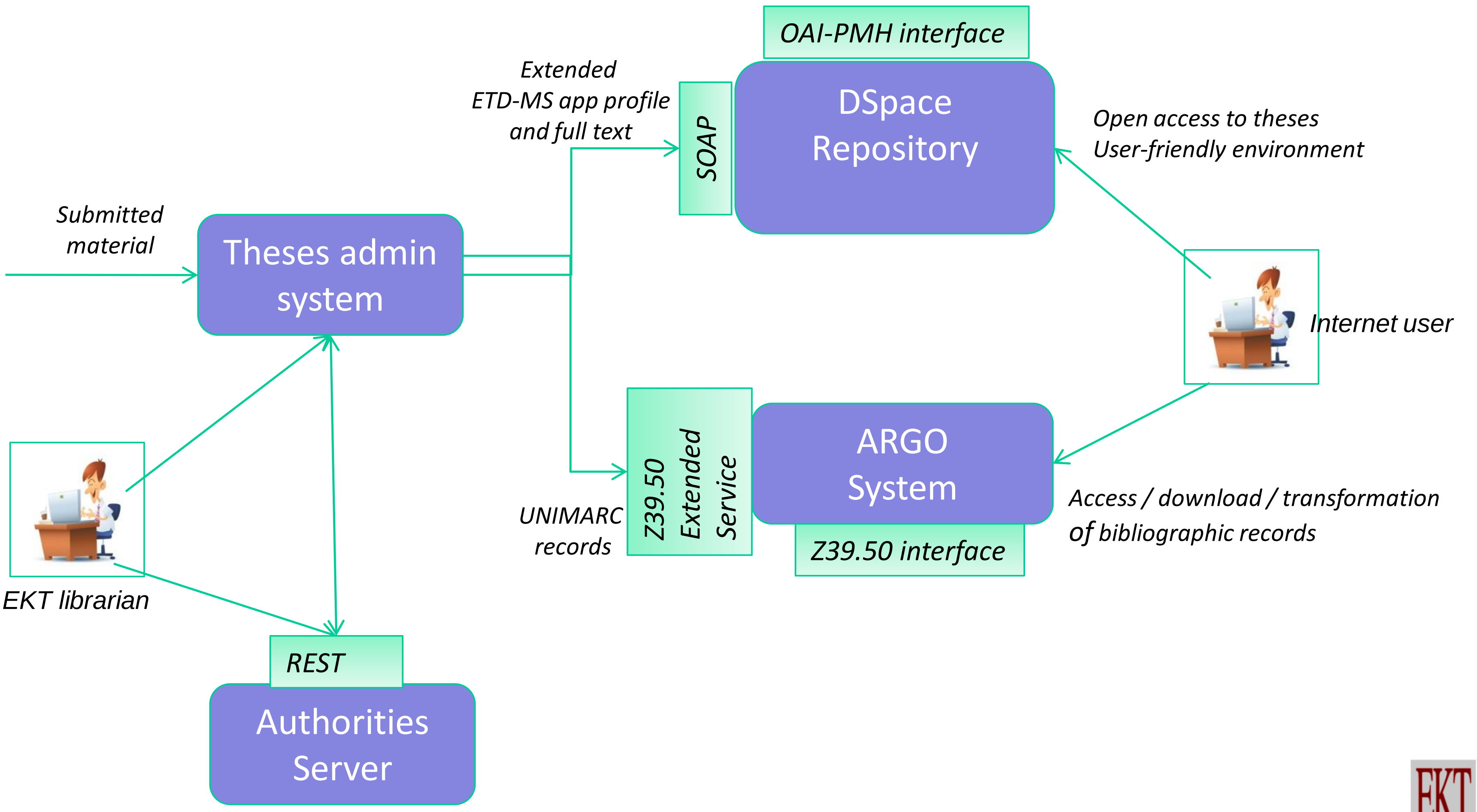
- National Documentation Centre (EKT / NHRF)
- Head, Software Development Unit

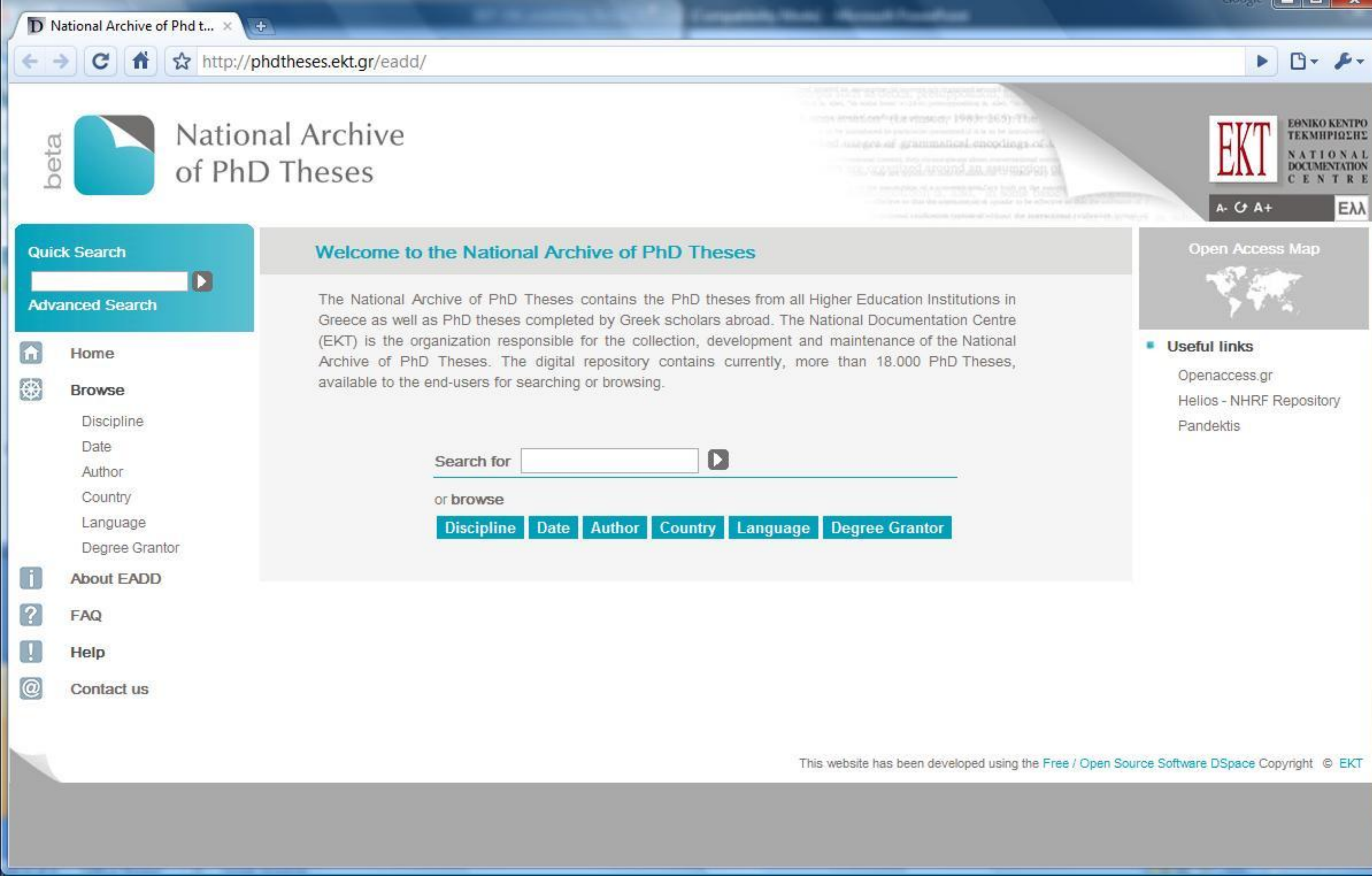
- euroCRIS BoardMember

Hellenic National Archive of PhD Theses

- All theses awarded by Greek Universities
- Theses of Greek scholars for PhDs obtained in foreign universities
- In operation at EKT (print archive) since 1985
- 24000 theses in total (since 1901)
- 25% theses not yet digitized
- 1200-1400 arriving every year
- Repository (http://phdtheses.ekt.gr), internal workflow management system and authority servers in a SOA configuration

System architecture

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Date	Title	Author	Full Text
2009	Συγκριτική μελέτη της επεξεργασίας πρότυπων διαλυμάτων οργανικών ενώσεων με προχωρημένες οξειδωτικές μεθόδους αντιρρύπανσης	*Βελεγράκη Θεοδώρα*	
2009	Εντοπισμός και επιδιόρθωση βλάβης σε δομικά στοιχεία με τη χρήση ευφυών υλικών	*Βουτετάκη Μαρία - Στυλιανή*	
2008	Πλαίσιο διαχείρισης και διαλειτουργικότητας πολυμέσων βάσει σημαντικής	*Τσιναράκη Χρυσή*	
2008	Μεθοδολογία μοντελοποίησης και βελτιστοποίησης υπολογιστικής νοημοσύνης ομάδας αυτόνομων οχημάτων	*Δοϊτσίδης Ελευθέριος*	
2008	Transmit beamforming to multiple cochannel multicast groups	*Καριπίδης Ελευθέριος*	
2008	Pattern recognition approaches in DNA microarray analysis	*Μπλαζαντωνάκης Μιχαήλ*	
2008	Ανάλυση των εξαγορών-συγχωνεύσεων στη Ελλάδα	*Σχοινιωτάκης Νικόλαος*	
2008	Γενετικοί αλγόριθμοι στο παίγνιο Cournot	*Πρωτόπαπας Ματθαίος*	
2008	Βελτιστοποίηση δομής και οικονομική αξιολόγηση απομονωμένου συστήματος ηλεκτρικής ενέργειας που βασίζεται σε ανανεώσιμες πηγές ενέργειας	*Κατσίγιαννης Ιωάννης*	
2008	Εξοικονόμηση ενέργειας στα συστήματα ηλεκτρικής ενέργειας αναπτύσσοντας προηγμένα ενιαία μοντέλα εκτίμησης κόστους κατασκευής και λειτουργίας μετασχηματιστών	*Αμοιραλής Ελευθέριος*	
2008	Βελτίωση των ελάχιστων ορίων ανίχνευσης ιχνοστοιχείων με ακτίνες Χ	*Κουλουριδάκης Παύλος*	

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Study of In2O3 and ZnO thin films for selective gas sensors applications: growth effect on the films structure factor in metal oxide thin films sensing applications

Abstract

The goal of this thesis is the study In2O3 and ZnO thin films for selective gas sensors applications with focus on growth effect on the films structure and surface topology as essential factor in metal oxide thin films. One of the main problems in the field of metal oxide thin film sensors is the impossibility to elaborate a unitary methodology for reproducibility of sensor response in correlation with the surface characteristics. For this, the systematic study of surface characteristics effects on metal oxide thin films sensing involved phenomena plays a major role. Using DC magnetron sputtering and pulsed laser deposition, nanostructured In2O3 and pure or doped ZnO thin films were grown and fully characterized. The study was focused on the morphology of the film and how this affects the photoreduction with UV light and the oxidation by oxidizing gas (ozone) exposure in order to optimize the film properties for gas sensing applications,. For this purpose, different series of samples were grown: In2O3 series by DC magnetron sputtering varying the following growth parameters: thickness, growth temperature and total pressure and oxygen:argon ratio during the deposition. Pure ZnO series by DC magnetron sputtering from metallic and ceramic targets varying the following growth parameters: thickness for different constant growth temperatures, temperature for constant thickness, total pressure and oxygen:argon ratio during the deposition. 2% Al doped ZnO by DC magnetron sputtering varying the following growth parameters: thickness and oxygen:argon ratio during growth. In doped ZnO thin films by DC magnetron sputtering varying the following growth parameters: thickness and oxygen:argon ratio during growth. Pure ZnO series by PLD varying the following growth parameters: thickness and substrate temperature with focus on very thin films (40nm and 100nm series at different growth temperatures). All films were fully characterized with respect to their structural and surface topology (for understating and optimization of the influences of the growth conditions on the surface properties), optical/electrical response (for understanding and optimization of the photoreduction and oxidation processes) and sensing behavior. Detailed surface characterization of each film surface was performed and results were collected for further correlation between surface properties and sensing response. Graphical correlations between surface parameters and sensor response ratios were done for each material studied.

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Alternative title	Μελέτη λεπτών υμενίων In2O3 και ZnO για εφαρμογές σε επιλεκτικούς αισθητήρες αερίων
Author	Suchea Mirela - Petruta
Date	2009
Degree Grantor	University of Crete (UOC)
Discipline	Natural Sciences Chemical Sciences
Keywords	Metal oxides thin films; Sensing applications; Indium oxide; Zinc oxide; Surface characterization; Atomic force microscopy; UV photoreduction-ozone oxidation;

http://phdtheses.ekt.gr/eadd/browse?type=subject

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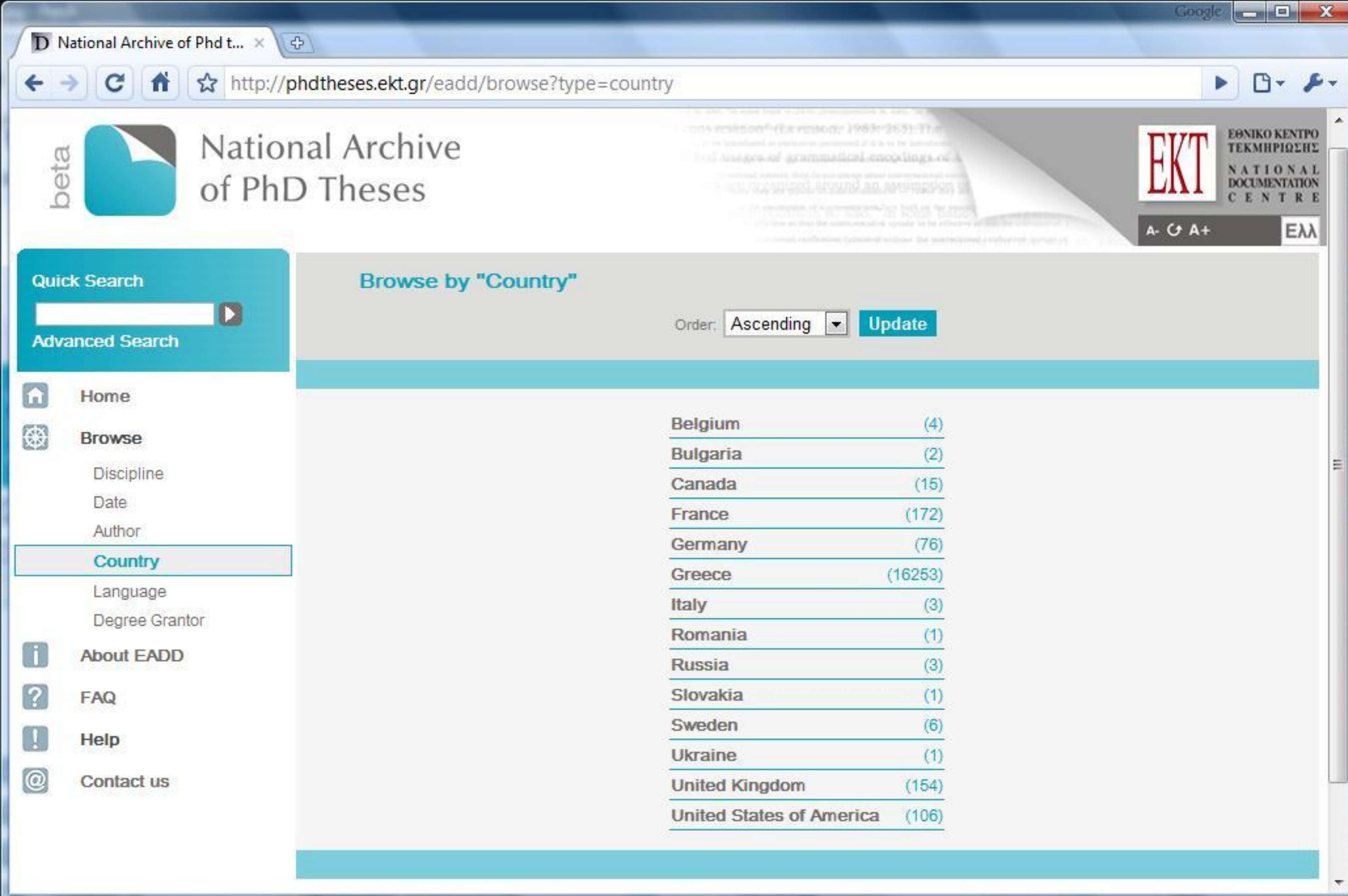
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- Better promotion of the overall system - back links to repository

Πανεπιστήμιο Κρήτης Τμημα Χημειας

University of Crete Chemistry Department

Study of In_2O_3 and ZnO thin films for selective gas sensors applications: Growth effect on the films structure and surface topology as essential factor in metal oxide thin films sensing applications

Ph.D. Thesis

Mirela Petruţa Şuchea

Ηρακλειο Νοεμβριος 2009

• Thermionic and field emission between bulk and surface electronic states with possible reflections at the surface
• Generation and recombination in the bulk
• Both majority and minority carrier transport in the bulk
• Thermionic and field emission between electrode contacts and the bulk.

Furthermore, the exact surface electronic structure is often not known. In the case of strong inversion, the analysis is quite analogous to that used in semiconductor device physics. Even if the coupling is well described, the calculation is not simple and the system can probably be simulated only numerically.

The analysis of changes in charge carrier mobility near the surface is often very complicated. The effect of surface roughness on the effective mobility of surface excess carrier due to band bending near the surface has been evaluated by Greene et al. [12]. A simpler analysis, giving out almost the same expressions, valid only for depletion and strong accumulation, can be found in reference 13. Later, more simple approximate expressions have been derived by Goldstein et al. [14]. For scattering by fixed surface charges under strong inversion it may be also possible to adopt an approach developed for MOSFET transistors [15].

If no Fermi level pinning is present at the surface, the screening length is given by the bulk extrinsic Debye length [13], given by:

$$L_D = \left(\frac{\varepsilon \varepsilon_0 k_B T}{q^2 (p+n)} \right)^{1/2}$$

where ε and ε_0 are the specific and vacuum permittivity, k_B is Boltzmann constant, T is the temperature, q is the electron charge and n and p are the densities of free electrons and holes respectively. In case of Fermi level pinning by "metal like" surface states, the scattering potential in the bulk will be a quadrupole potential decreasing as $1/r^3$. The screening in the surface plane is given by the 2D screening length [16] given by:

$$\beta^{-1} = \frac{1}{2}\sqrt{a_B d}$$

where $a_B = 4\pi\varepsilon\varepsilon_0 h^2/m^* q^2$ is the Bohr radius, m* being the effective mass and d is the thickness of the 2D system. The surface screening length is of the order of a few nanometers.

All this information is very useful and applies quite well locally in a very narrow region or for epitaxial growth, but it becomes practically impossible to be used for the explanation/understanding of the behavior of real polycrystalline films.

Conduction mechanisms

The oldest models, regarding conduction mechanism in polycrystalline films, are based on the grain boundary conduction model - developed by Petritz [17] in 1956, which is based on the assumption that the conductivity behavior in polycrystalline films closely approaches that of semiconductors with predominant grain boundary conduction mechanism. The carrier mobility in these films is limited by scattering at the surface and the grain boundaries as well as by normal bulk processes. A model of intergrain boundaries affected by the diffusion of an active gas has been used by Seager and Ginley [18] to explain the changes of conductivity seen in polycrystalline silicon. As found out, diffusion of oxygen down the grain boundaries promoted in these regions significant changes in the density of defect states, resulting in a decrease of conductivity. This model, described extensively by

Seager and Castner for the case of polycrystalline silicon [19], has been adopted until now as the basic approach to explain the conductivity mechanism in polycrystalline metal oxide films. The validity of this model has been confirmed in polycrystalline metal oxide films by experimental results related to the dependence of the conductivity on the temperature, but it cannot explain experimental results when the films are used as sensing layers or when photoreduction is involved.

The main features of this conduction model are: conduction from grain to grain, disturbed by surface barriers which are strongly influenced by chemisorbed oxygen.

The formation of potential barriers at the grain boundaries was proposed by Petritz [17] in 1956, in addition to the normal lattice discontinuity caused by the boundaries. Other models have also been proposed to explain the transport behavior due to the grain boundaries, as that of Volger [20] and Berger [21]. Since then, this subject has been reviewed in detail by Kazmerski [22], while, more trials also appeared using different approaches like the ones of Gardner [23, 24], Bârsan and Weimar [25, 26].

Petritz theory constitutes the basic theoretical analysis of transport mechanisms in polycrystalline semiconducting films. According to this model, grain boundary potential barriers are formed in an n-type semiconductor when the grain boundary region has a lower chemical potential (Fermi level, E_F) for majority carriers, than the grains, due to the density of defect states in this region. These defect states can appear due to the tendency of grain boundaries to act as diffusion whirlpool for impurities. Therefore, these defect states can be treated as trapping centers for majority carriers, resulting in a reduction of their concentration in the boundary region. This in turn causes a flux of majority carriers into the boundary region, creating a space charge build up at these boundaries, which prevents further flux of majority carriers and therefore forms a depletion region for them. This can be presented in a band diagram by an upward bending of the conduction and valence band edges. For a p-type semiconductor respectively, the band edges bend down, toward the Fermi level.

The accumulated negative charge near a joint force the energy bands to be bend upwards by an amount of Φ_B. Since the Fermi energy at equilibrium must be continuous over the grain boundary, the height of the potential barrier, $e\Phi_B$, will be given by the difference of the Fermi's grain-boundary energies. Majority carriers can cross over a grain boundary potential barrier, following two different mechanisms. One is the thermal emission over the barrier and the other is the quantum mechanical tunneling. For the evaluation of electrical characteristics of semiconducting films, most models compare the behavior of the films to that of the bulk crystal. If the bulk crystal was perfect, the conduction carriers could flow unimpeded in a perfect periodic potential. In a real bulk crystal lattice, vibrations, impurities and defects can cause deviations from the ideal behavior, an approach that can be used in polycrystalline thin films analysis, which, however, can result is quite inexact results. The carrier mobility is related directly to the mean free time between collisions, which in turn is determined by the various scattering mechanisms. For bulk crystal behavior in semiconductors, two scattering processes are important: lattice scattering and ionized impurity scattering. In polycrystalline semiconducting films, however, the effect of the grain boundaries should be also considered as an additional scattering mechanism for the carriers. The carriers collide at the grain boundaries and, in a steady state, have an effective mean free path λ_G, constrained by the size of the grains, and a mean

Conduction mechanisms

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The main features of this conduction model are: conduction from grain to grain, disturbed by surface barriers which are strongly influenced by chemisorbed oxygen.

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Studies / reports commissioned by government organisations

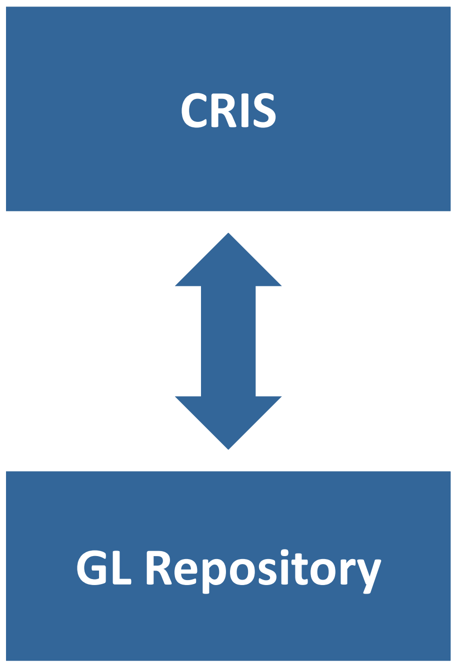
- Work funded by governmental organisations and done by companies, universities, research centres, individuals
- Important material for diverse audiences
  - Significant facts and findings
  - Spatial and temporal focus
- Wide range of disciplines – particularly important for social sciences

Requirements

- For the general public:
  - Dissemination of the material to interested users
- For government organisations:
  - Avoid allocation of funding for work already done in the past
  - Transparency regarding where public funding goes - reporting on contracts awards for studies to specific individuals and organisations

System architecture

Complex links / roles
Reporting
Evaluation



Persistent ids to docs
Content presentation
Rights
Access statistics

Example links / roles

Organisation - Project:
Funder / Supervisor / Contractor

Person - Project:
Coordinator
Team leader
Team member
Evaluation

Repositories – more emphasis on digital content?

- Presentation of content adapted according to
  - type (book, article, data set, …)
  - form of digital material (text, image, …)
  - devices: e-book readers, tablets, smartphones, …
- Improvement of user experience regarding content presentation – in addition to downloading files
- Full-text search and hit highlighting.
- Automatically checking the quality of digital content upon submission and helping the submitter improve it.

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Devices

Potential environments for repositories

- Research: CRIS, IR, VRE
- E-Learning - VLE / LMS and Learning Object Repositories
- Workflows for the production of content -> EKT HEDI system
- E-Publishing
  - Peer review management systems
  - Reproduction rights management systems
- Content re-purposing

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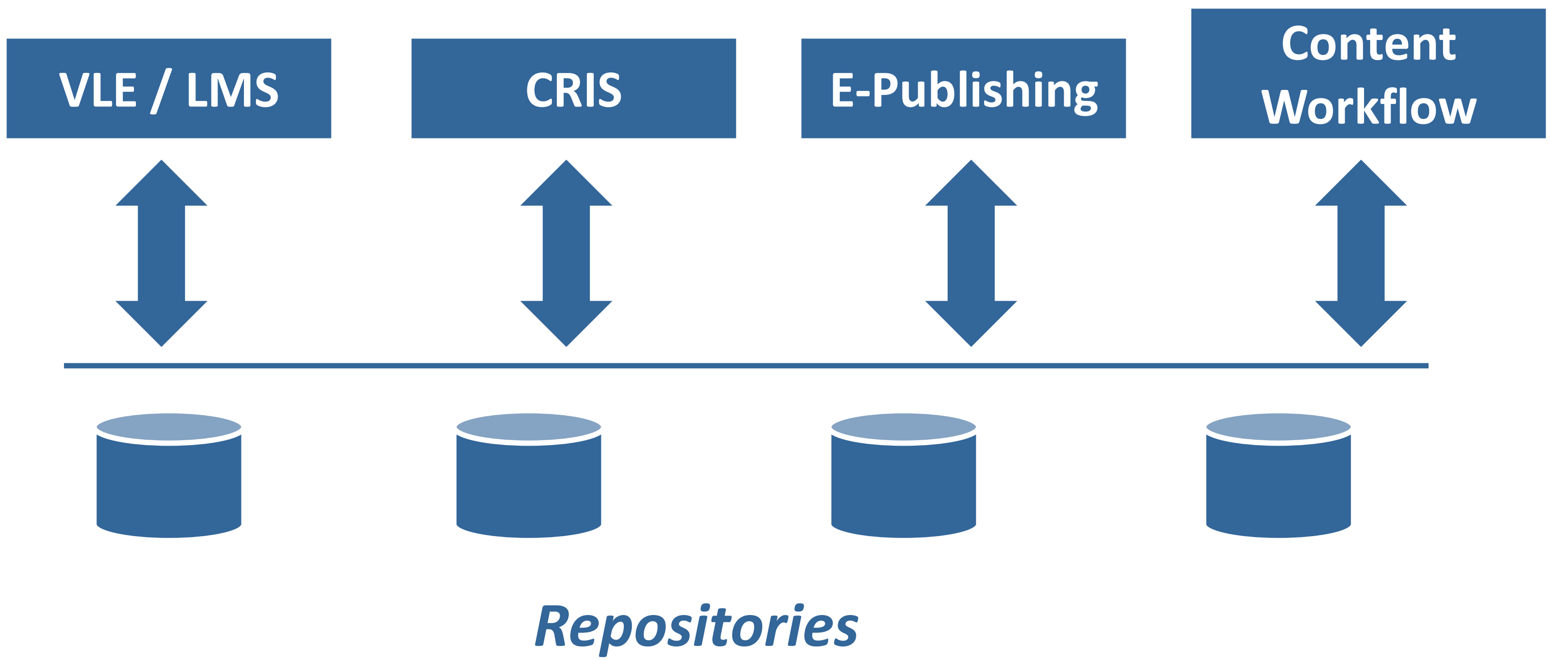

Requirements beyond existing standards

- Full CRUD APIs (Not only deposit / SWORD)
- Retrieval – update of digital material (full text)

Thank you