Technische Universitaet Berlin

Elena Eyngorn
Ruslan Muydinov

Facts and Figures

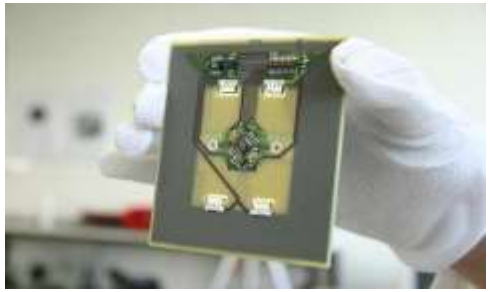
Students		32.000
female		10.300
international		6.000
Faculties (Schools)		7
Degree programs		109
Professors		400
Scientific staff		2.364
Other Staff		4.402
PhD/year		**460**
Budget:		
From government	280	Mio. €
Additional (third party) funds	170	Mio. €

Faculty	Name	Institutes
I	Humanities	7
II	Mathematics and Natural Sciences	6
III	Process Sciences	6
IV	Electrical Engineering and Computer Sciences	6
V	Mechanical Engineering and Transport Systems	7
VI	Planning – Building - Environment	8
VII	Economics and Management	3

Strategic research topics

4 Main Points at Chair of Space Technology

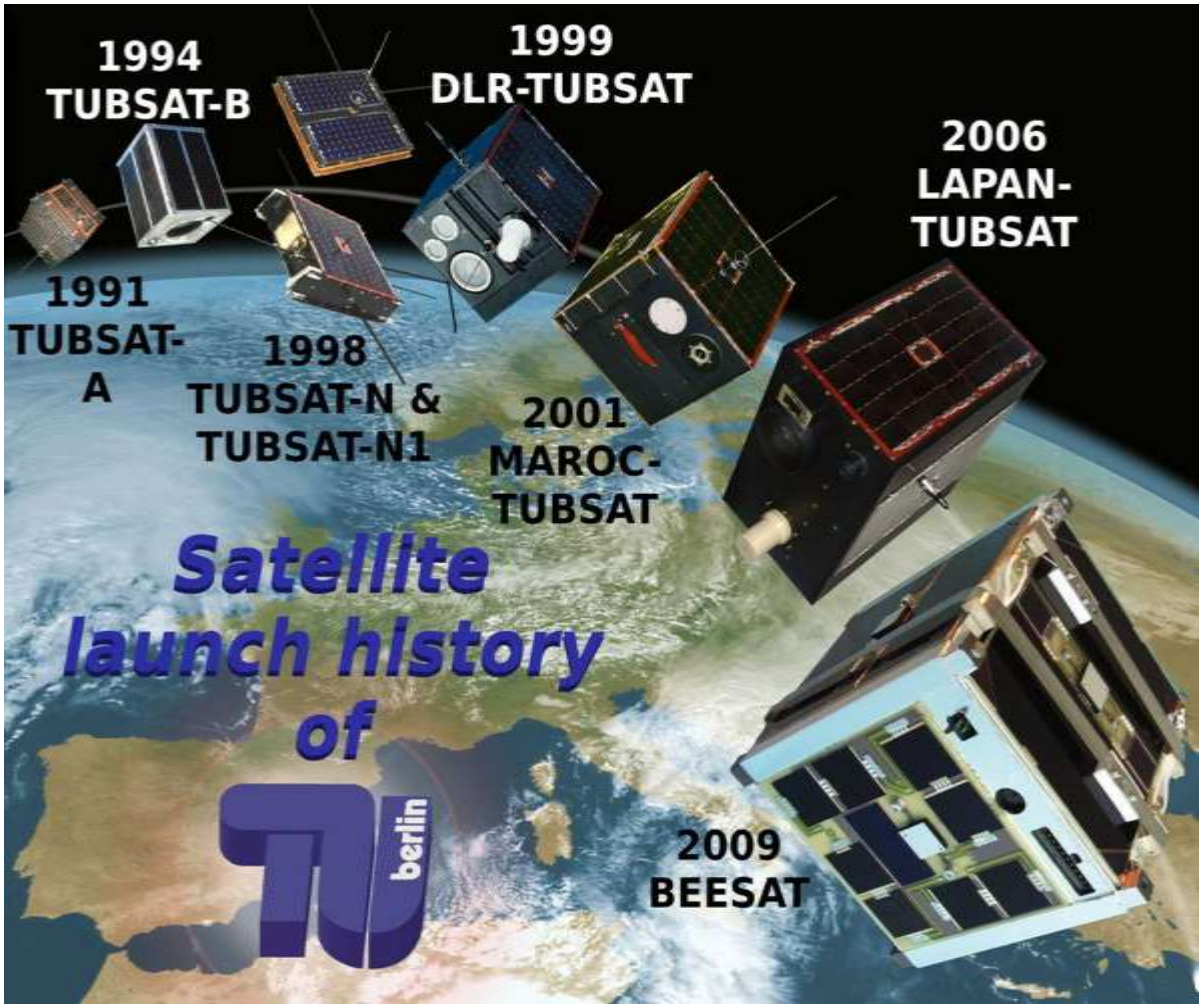
Curricula in Space Technology



Space Technology Research

Theoretical and Hands-on Education in Satellite Technology

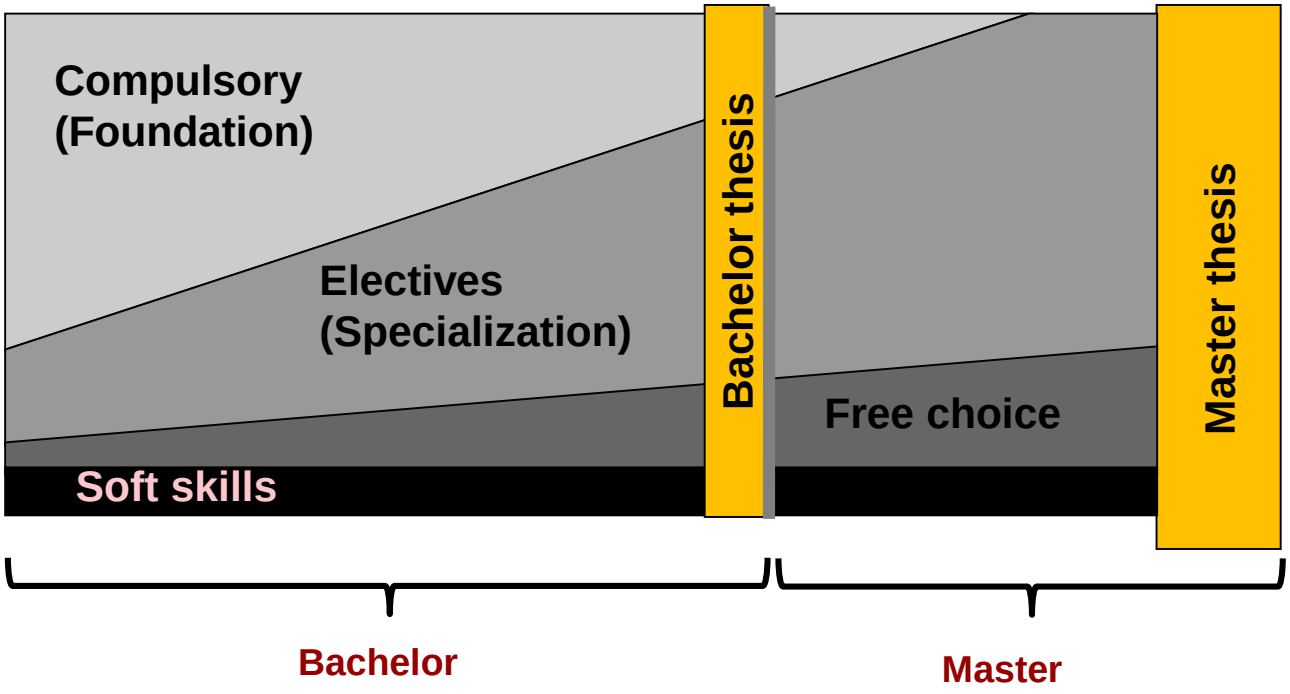
Theoretical and Hands-on Education in Rocket Technology



BEESAT-2,-3. April 2013		
in preparation		
2014	TUBIN	20 kg
2014	BEESAT-4	1 kg
2015	TECHNOSAT	15 kg
2015	S-NET	4 X 10 kg

University: images

Profile of our programs



Introduction to Module Soft Skills for Engineers

-Effective communication with groups: 2 ECTS, 40 hours
-Survival in Labor Market: 2 ECTS, 40 hours

<u>Professional development programs support Ph.D students in:</u>

- research integrity
- teaching skills
- research paper writing and presentation skills
- innovation and technology entrepreneurship
- communication and leadership
- presentation techniques

<u>Engineering students:</u>

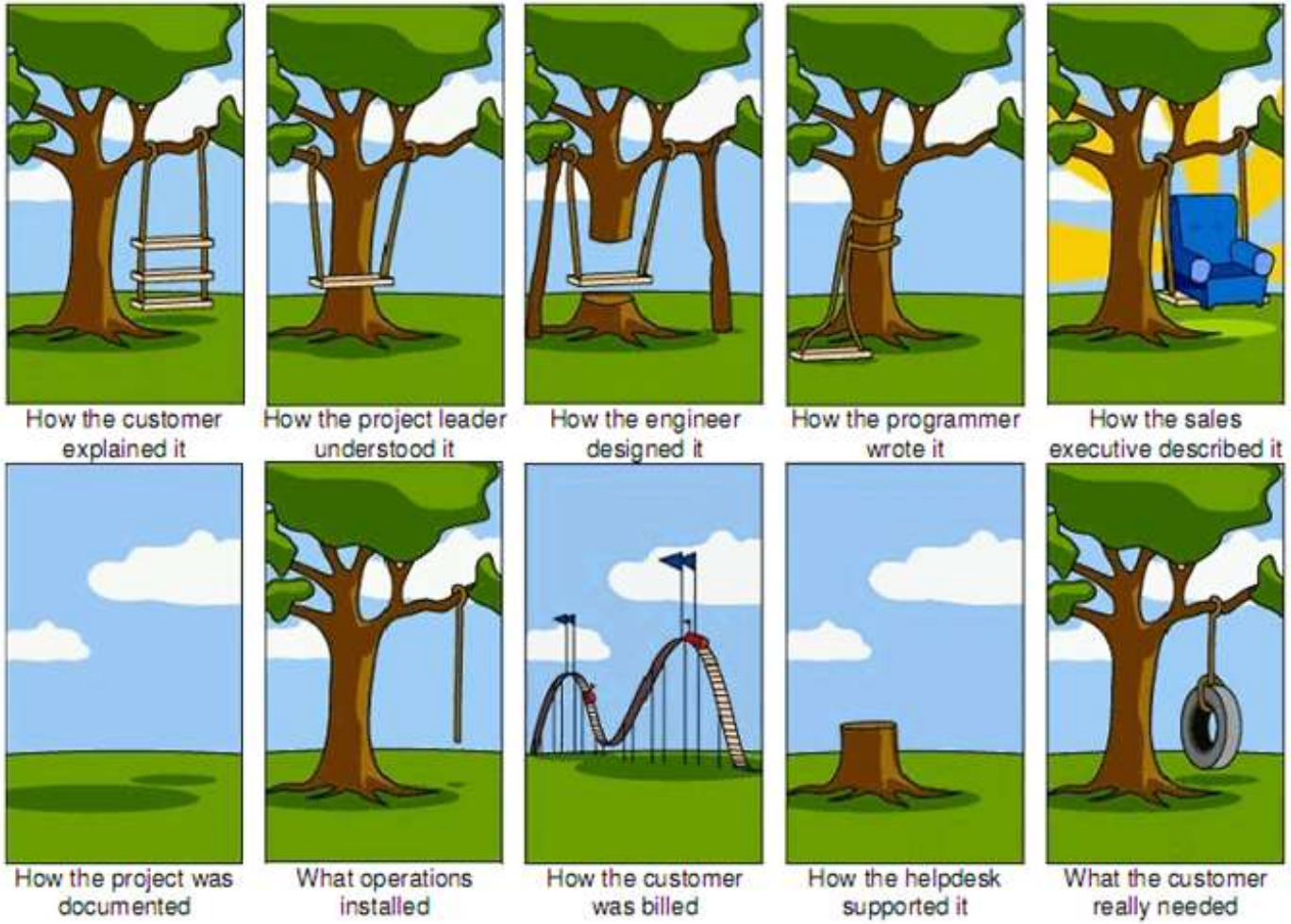
- engineering ethics
- technology entrepreneurial skills
- communication and teamwork
- management

How to prepare scholars and high quality professionals for diversified career paths?

A new Culture of Learning & Teaching

- From transmission of knowledge to learning how to learn
- From over-emphasizing academic studies to focusing on whole-person
- From compartmentalized subjects to integrated learning
- From reliance on textbooks to use of diversified teaching materials: e-tools
- From premature streaming to providing more opportunities for students to explore their aptitudes and potentials

What are soft skills?



Local project team.

Dmitry Ostroverkhov

Elena Eyngorn

Ruslan Muydinov

Thin Films in Energy-Efficient Technologies

Тонкие пленки в энергосберегающих технологиях.

45 contact hours + 30 hours student workload
~**22** lectures + ~**10** practicums
} **3 ECTS**

Dr. Ruslan Muydinov

к.х.н. Руслан Муйдинов
(специальность «Материаловедение»,
МГУ, Химический Факультет)

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Tel. 030 31422909, Fax. 030 31424626

2006 – PhD (MSU)

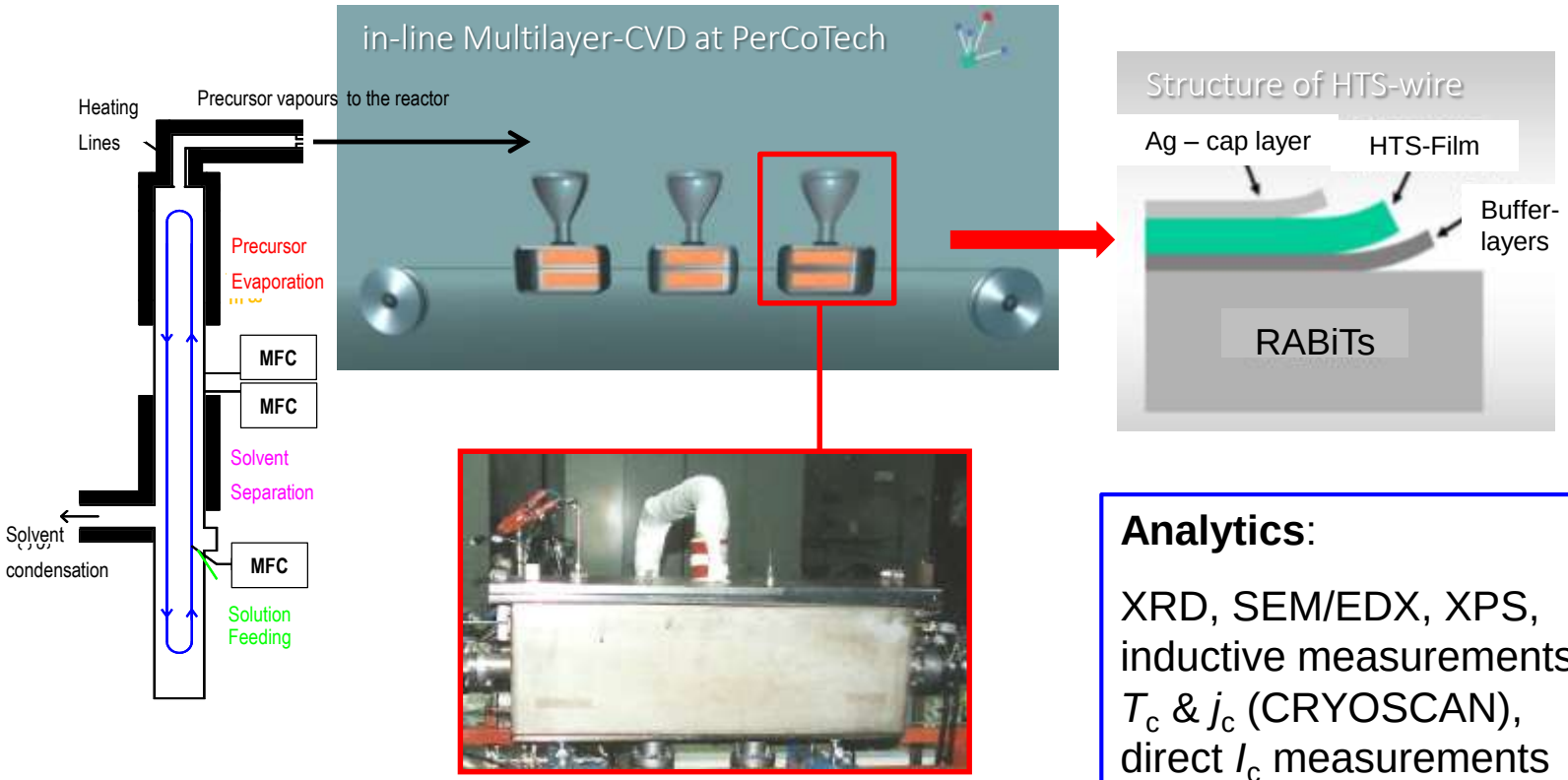
2007-2008 – PostDoc at Institute for Surface Technology (IOT, TU Braunschweig)

2009-2012 – Project Manager at PerCoTech AG (TU Braunschweig)

2012- … Senior Scientist at Department of Thin Film Devices (HFT, TU-Berlin)

My experience: MOCVD + HTS (2nd Gen. Wires)

IOT, PerCoTech AG, TU Braunschweig

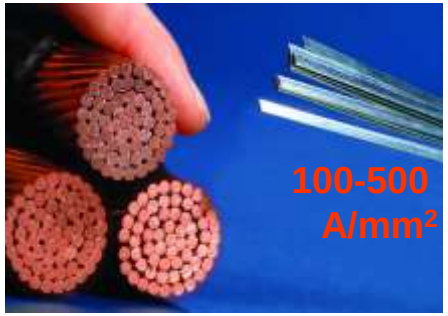


Analytics:

XRD, SEM/EDX, XPS, inductive measurements of T_c & j_c (CRYOSCAN), direct I_c measurements

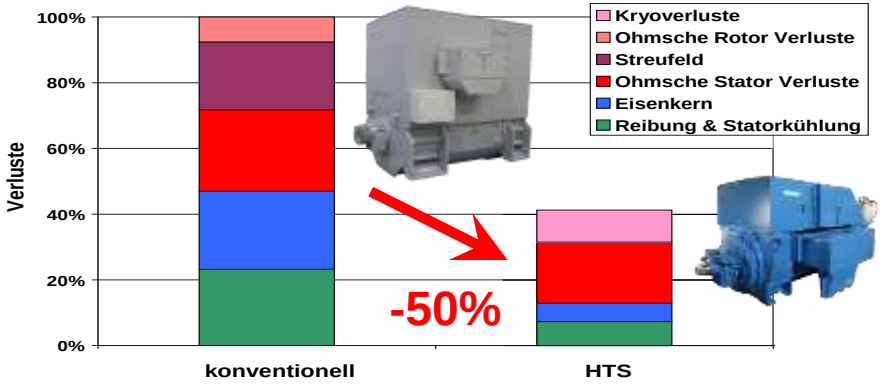
Superconductive Wires

Wires / Energy density



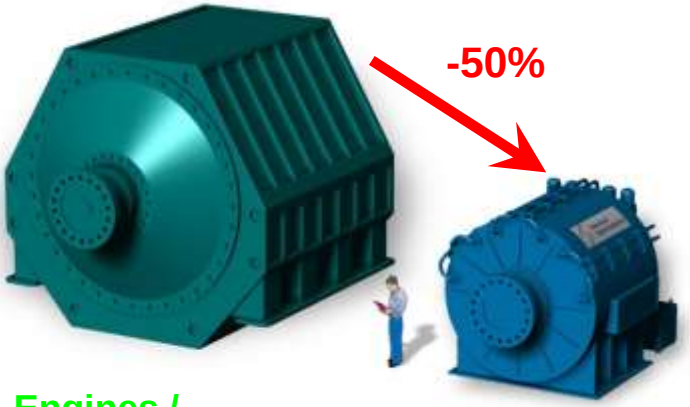
1-5 A/mm²

Generators / Energy losses



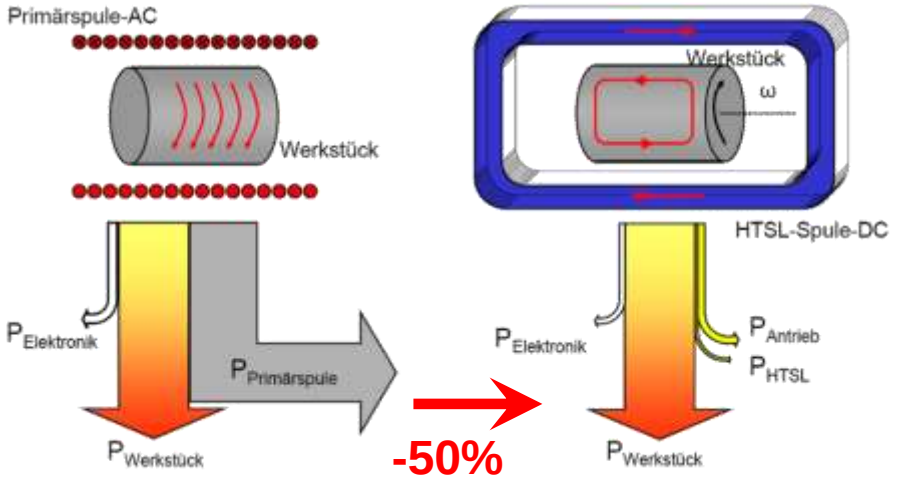
η = 97.0 % η = 98.7 %

Engines / Size-weight

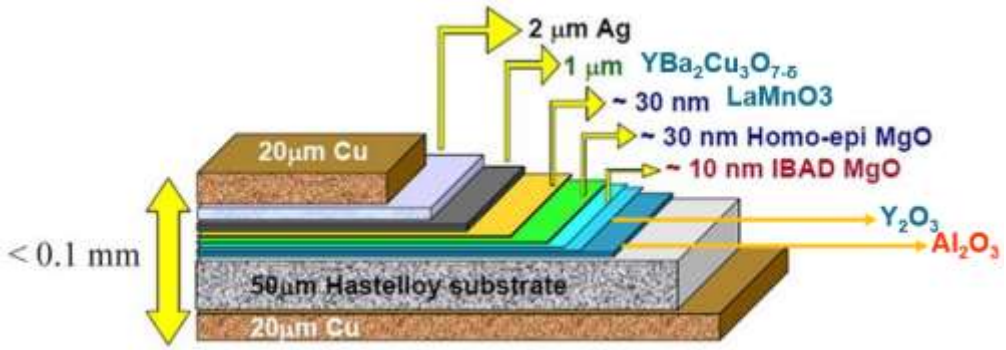


36,5 MW Ship engine
(American Superconductor)

Inductive heater



Curriculum:
Content and Context



Thin Films in Superconductivity
6_{22} Lectures / 3_{10} Practicum

1. Effect of Superconductivity (Hystory, Effects, Materials). **2** lectures
2. HTS-Wires and thin film technologies. **2** lectures
3. Applications of HTS-wires (generators, motors, cables, FCLs, magnets). Economical aspect. **2** lectures

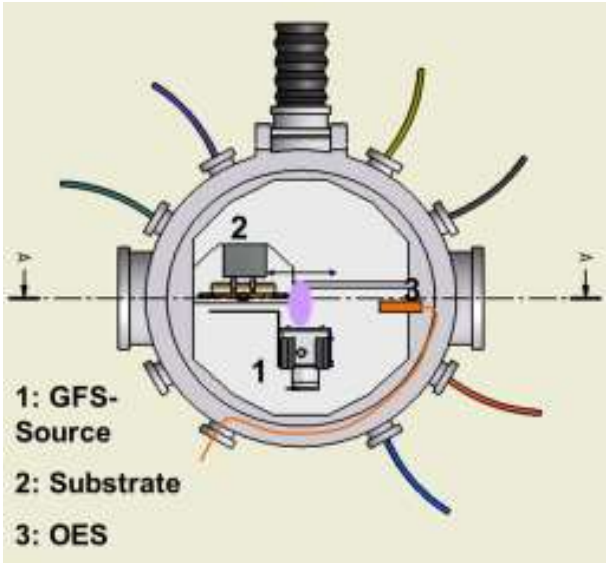
1. Observation of levitation-effect on ceramic YBCO-sample over the magnets. Freezing of magnetic fluxes in superconductor. Small seminar (effects).

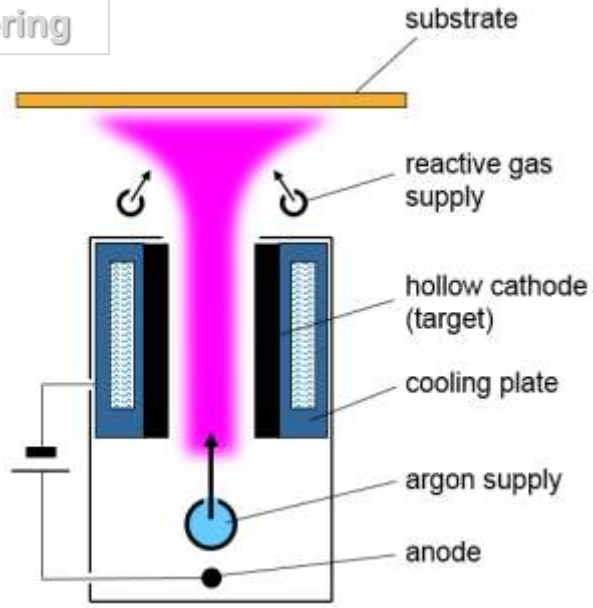
2-3. XRD measurements on epitaxial YBCO-films. Determination of *in-plane* and *out-of-plane* textures. Determination of epitaxial and polycrystalline fractions of a film.

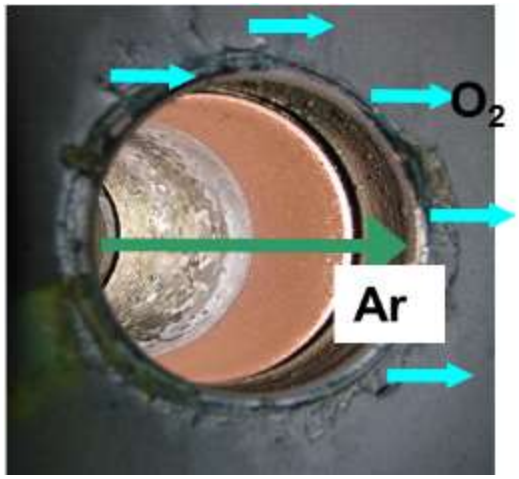
My experience: PVD (GFS, DC/RF-MS) + TCOs

HFT, TFD, TU-Berlin

Hollow Cathode Gas-Flow-Sputtering







- Scalable system up to 1 m offered by FhG-IST
- Control by OES and / or pressure (1..10 mbar)
- More than 20 units installed

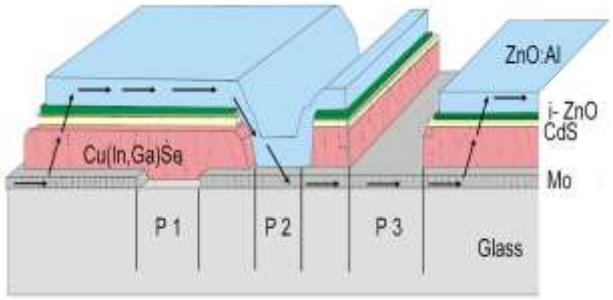
- Sputtering of conductive ring segments
- Chemically active zone
- Remote process, no arcing due to purge gas
- Dense plasma / low energy, mbar, high rate

Analytics:

UV-Vis, Ellipsometry, Profilometry, Conductivity/Hall-Effect meas., overall and quantum efficiency measurements, optical properties modelling

T. Jung et al., Surf. Coat. Technol. 86-87 (1996) 218 |B. Szyszka et al., Thin Solid Films 518 (2010) 3109

Curriculum: Content and Context



Thin Films in Photovoltaic

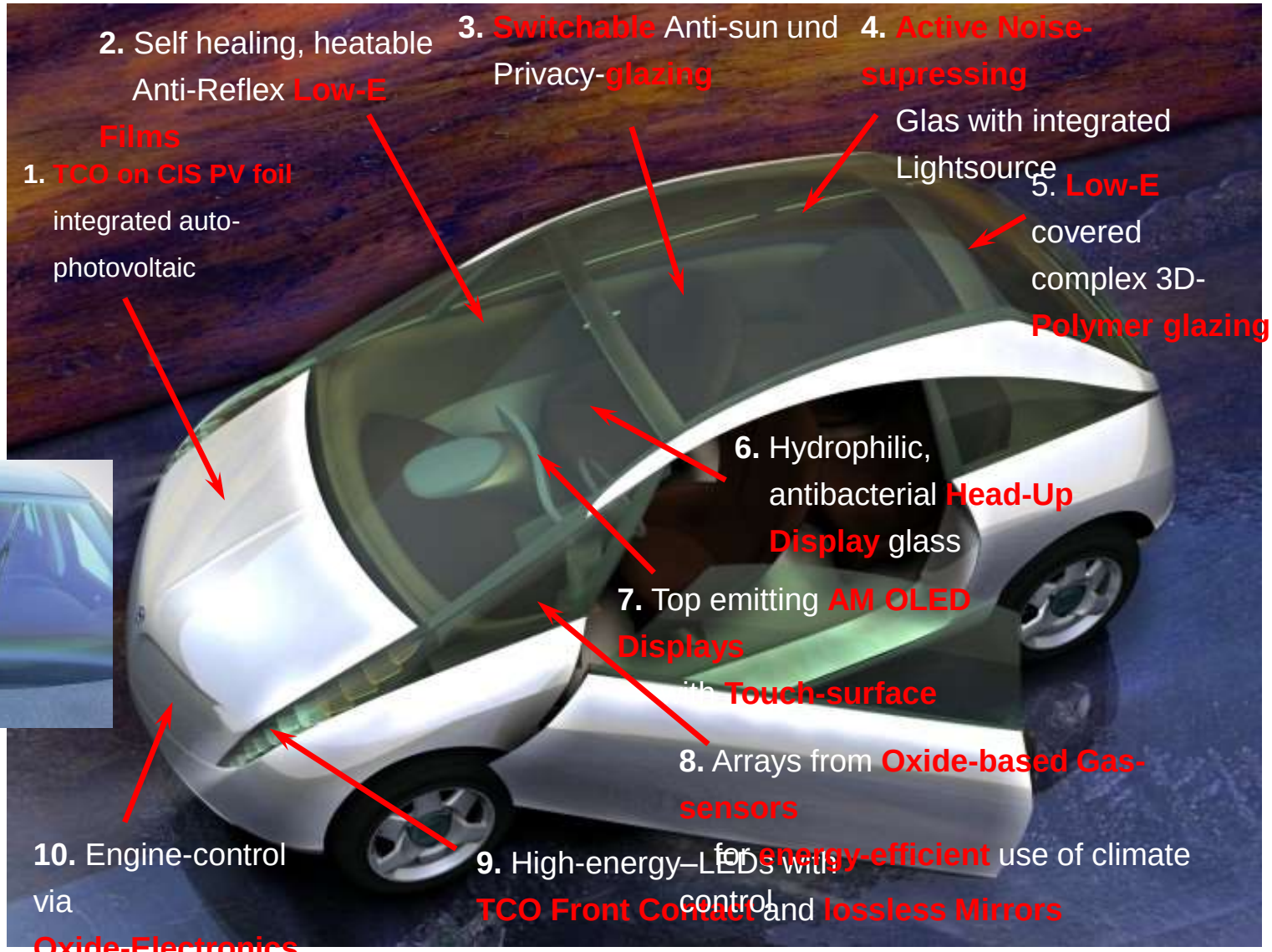
8_{22} Lectures / 4_{10} Practicum (devoted to TCOs)

1. Photovoltaic (economical motivation, principles, problems, approaches). **2** lectures
2. Si-thin film' photovoltaic (materials, technological features, restrictions). **2** lectures
3. CIGS-thin film' photovoltaic (materials, technological features, restrictions). **2** lectures
4. New approaches in thin film' photovoltaic (OPV, flexible photovoltaic, perovskite-ETAbsorber etc.). **2** lectures

1-2. UV-Vis measurements (TT/RT/absorption, diffuse vs. specular reflection, angular resolved measurements, haze determination).

3-4. Ellipsometric measurements. Conjugated fitting with UV-Vis data so to get μ, N_e, refractive index, film thickness and model description of layers. Hall-effect- and 4-point conductivity measurements to approve a fitting model.

TCOs – broad application.



Curriculum: Content and Context

Thin Functional Films – Creation of Properties

8_{22} Lectures / 3_{10} Practicum

1. Deposition techniques (PVD, PLD, CVD, PECVD, ALD, spin-coating, dip-coating) and growth mechanisms. — **3** lectures
2. Analytical methods devoted to structure, microstructure and composition of thin films (XRD-stresses' analysis, mechanical properties, EBSD, SEM, AFM, EDX, EPMA, XPS). — **3** lectures
3. Examples of multilayer systems (low-E, mechanically stable, epitaxial films' stacks). — **2** lectures

1-2. Determination of a film thickness (profilometry, SEM).
3. XRD measurements: determination of stresses in a crystalline film.

Our team at TU Berlin

Fakultät IV: Elektrotechnik und Informatik

HFT: Institut für Hochfrequenz und Halbleiter-system Technologien

TFD: Thin Film Devices

Prof. B. Szyszka

1 PostDoc, 1 PhD, 1 Master-student,
1 engineer, 1 workman, 1 Secretary…