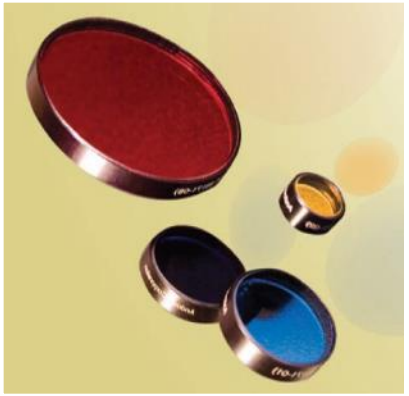
MCT – Material Center Tirol

Head: Dr. Georg Strauss

Scientific partners:

Universität Innsbruck, Fakultät der technischen Wissenschaften
Institut für Konstruktion und Materialwissenschaften
Arbeitsbereich: Materialtechnologie
Prof. Dr. Roman Lackner



Content

The fascination of functional surfaces produced by thin film technology

- Presentation of MCT
- Typical applications and examples
- Functional surfaces
- PVD (Physical Vapour Deposition) technology
- Some realised examples

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Faculty of Technical Science at the University of Innsbruck
Institute of Construction and Material Science
Department: Material Science – Surface and Thin Film Technology

Material Technology

- Material characterisation
  - Mechanical properties
  - Transport properties
  - Thermal properties
- Material development
- Process optimisation
- Sustainability
  - demage mechanism
  - Recycling
  - Cycle of materials
- Measurement and Monitoring

Surface and Thin Film Technology

- PVD-Technologies
  - Magnetron-Sputtering: dc,dc-pulsed
  - Arc Source: dc,dc-pulsed
  - Gasflow-Sputterning
- Prozess- und Plasma Analysis
  - Plasmamonitoring
  - Langmuir-Sonde
  - Optical Emission Spectroscopy
  - Faraday Cup System
- Process optimisation
  - Efficiency, Stability, Reproduction, Upscaling
- Target tests

Surface and Material Analysis - NanoLab

- Chemical analysis
- Material analysis
  - REM-EDX
  - IR Spectroscopy
  - XRS and XPS
- Porenraumanalytik
  - FIB-SEM Microscopy
  - Mass analytics
- Surface analysis
  - Infinite Focus Microscopy
  - AFM - Atomic Force
  - Nano- and Micro-Indentation

Modelling and Simulation

- Multi Scale Modelling
  - Optimisation of materials
  - Influence of parameters
- Simulation - Numerical methods
  - Producrion process
  - Handling process
  - Damaging process
- Calculation tools
  - Prozessbegleitung
  - Qualitätssicherung
  - Schadensanalyse

Partners of MCT:

Institutes and facilities of University of Innsbruck
MCL - Material Center Leoben
PhysTech Coating Technology GmbH
Plansee SE
RHP Technology

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MCT – Material Center Tirol

Applied science and development in the field of Material science, Surface scienc and Thin film technology – Networking– UIBK – regional companies

Science and Technology service
Workout of technology questions and problems, Feasibility studies, small projects, networking

Industrial projects (typ. 1-3 years)
Specific scienific tasks and developments together with regional companies

Education
Integration of surface science and thin film technology into the university education: lectures, exercises. Practical exercises, seminare, workshops

Science and development
Generel scientific research and development, international scientific research projects

Thin Film Technology

Functionalising of surfaces by PVD technologies

Thin films produced by PVD technologies
can show a lot of specific properties
⇨ from nm to μm

- they make tools hard and wear resistant
- they transmit, reflect or filter light
- they protect and decorate surfaces
- they isolate against heat or coldness
- they improve electric conductivity
- they realise diffusion barriers

Thin Film Technology

- Tribology
- Optics
- Surface protection
- Tools
- Medical Implantats
- Electronics

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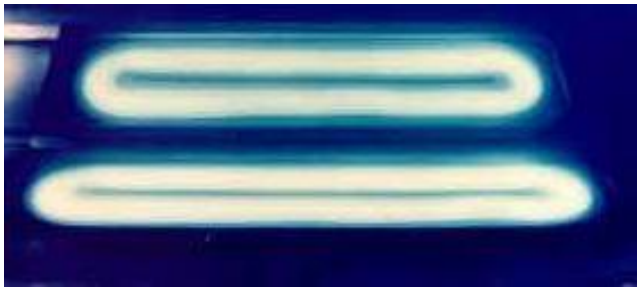
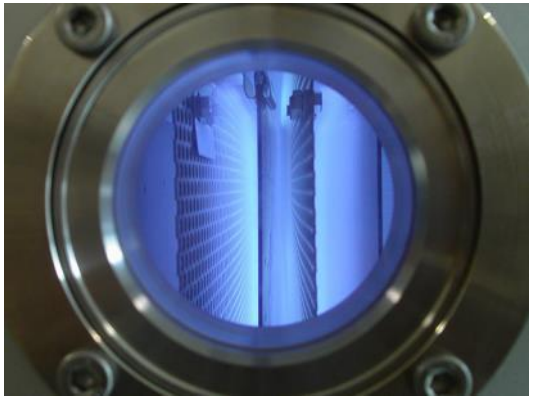
Typical applications

Activation of plastic parts



Magnetron sputter plasma for the deposition of optical thin films

PVD/PACVD
Hauzer – Batch Coater
Tools – Tribology – Surface protection



Cleaning of metal parts by plasma pre-treatments

Typical applications

Decorative hard coatings, e.g. TiN, TiAlN, CrN, CrON, TiC, DLC

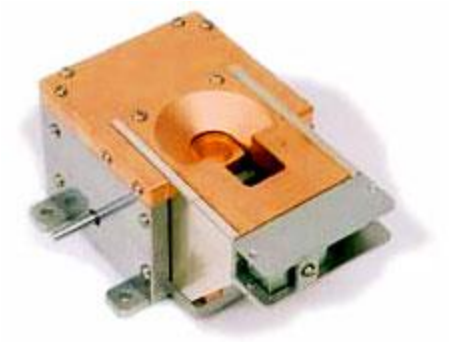
Grey	Black	Gold	Red	Others
Stainless Steel	Anthracite	Gold 24K	Copper Rose	Flat Dark Earth
Nickel	Black	Gold 18K	Bronze	Sand
Smoked Grey	Black	French Gold	Brass	Rainbow

PVD technology

Coating material transfer mechanisms

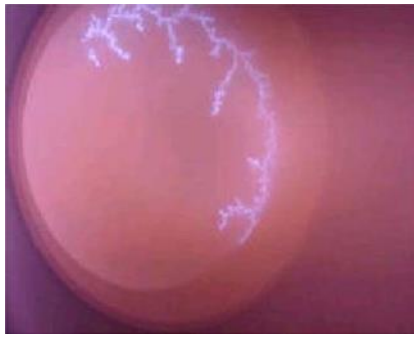
Three fundamental mechanisms

Evaporation
Sputtering
Exploding Plasma Ablation



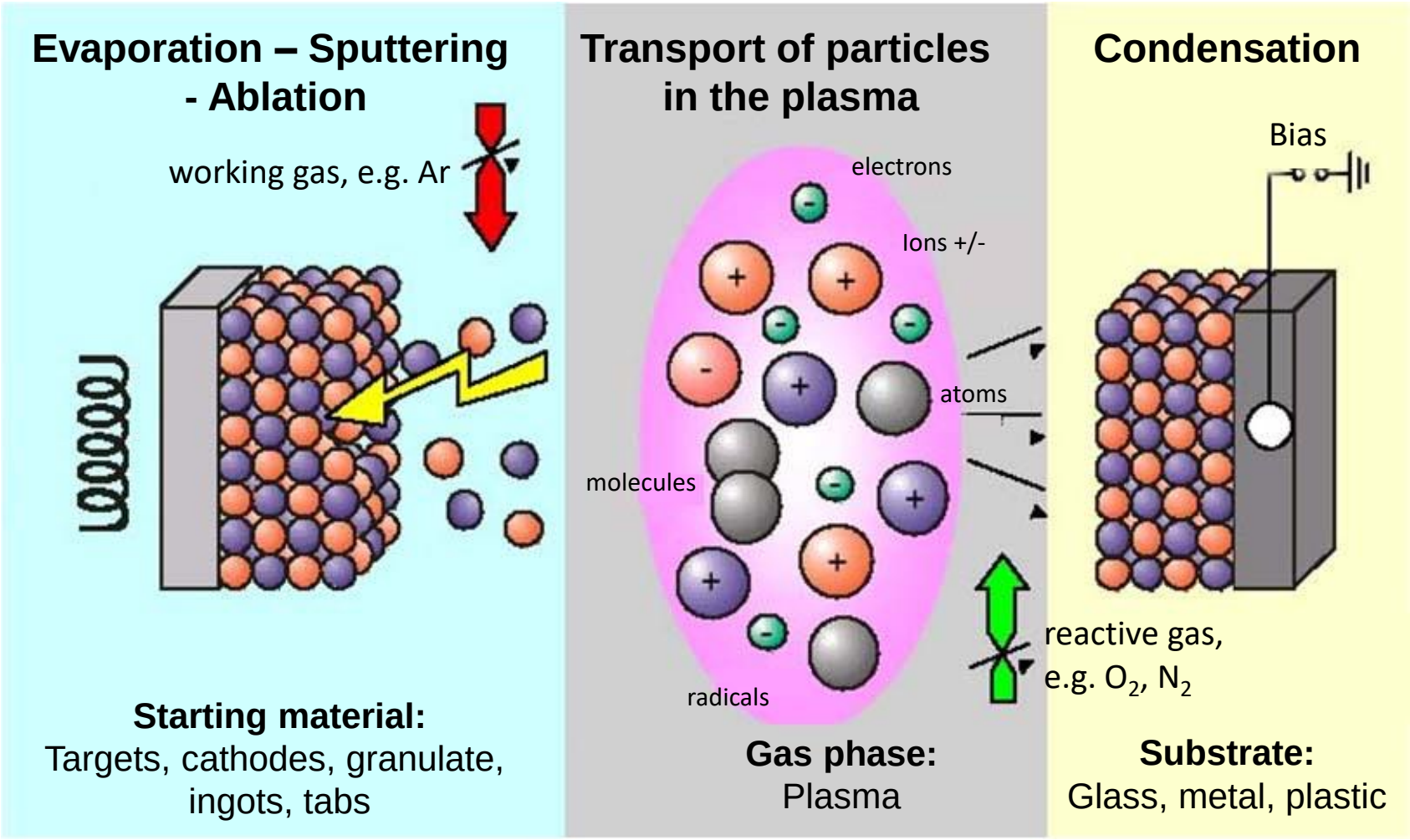
E-gun for evaporation

magnetron plasma



arc source deposition

PVD technology



PVD technology

Magnetron Sputter Coater (MCT)

PVD technology

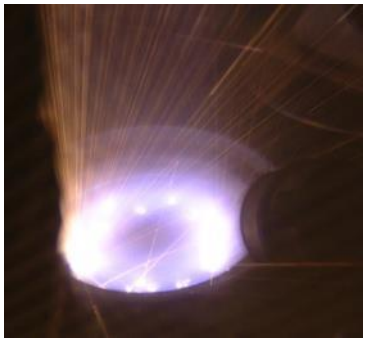
Arc Source Deposition (PhysTech)

PVD technology

Gas-Flow-Sputtering (PhysTech)

Research activities

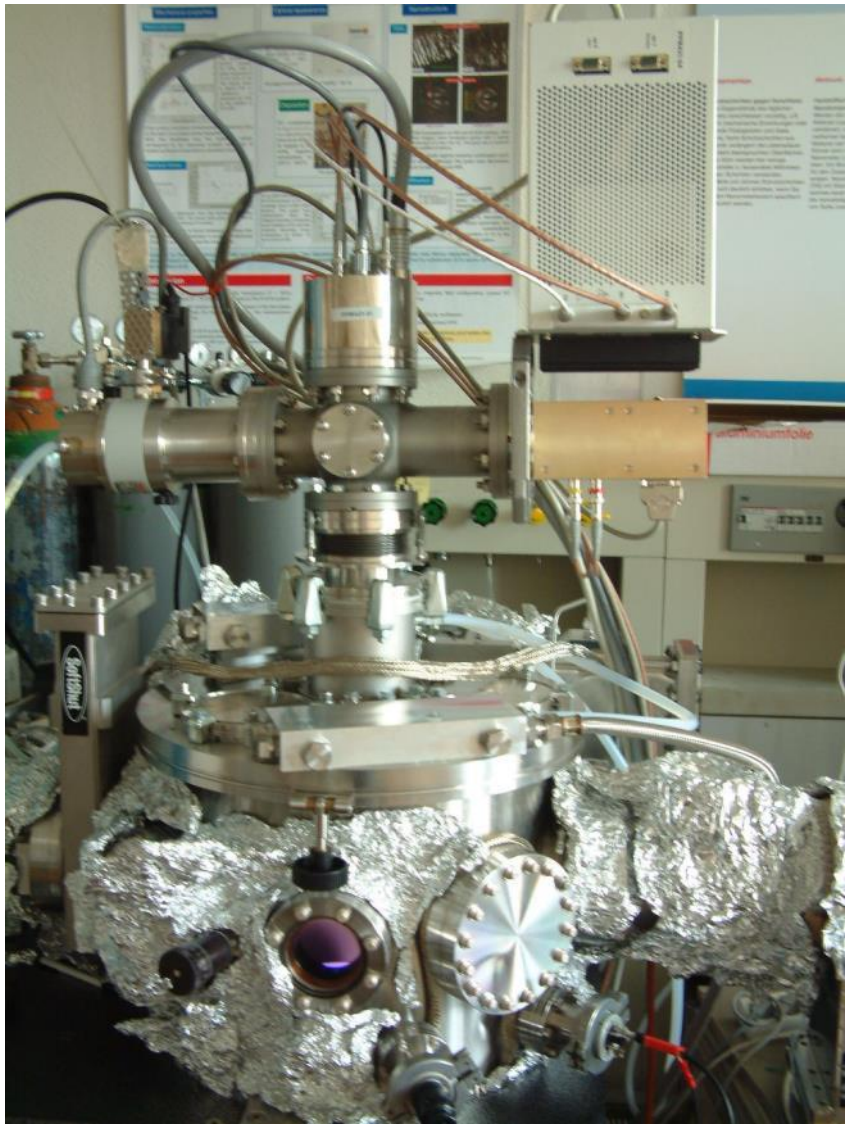
- Development and optimisation of new materials
- PVD process characterisation and plasma analysis
- PVD process adaption: functionality, material, up-scaling
- Test of process parameters and parameter fields
  WHICH parameters control WHICH PROPERTIES ?
- Reproducibility: long term stability of processes
- New developments – tests
- Production of prototyps



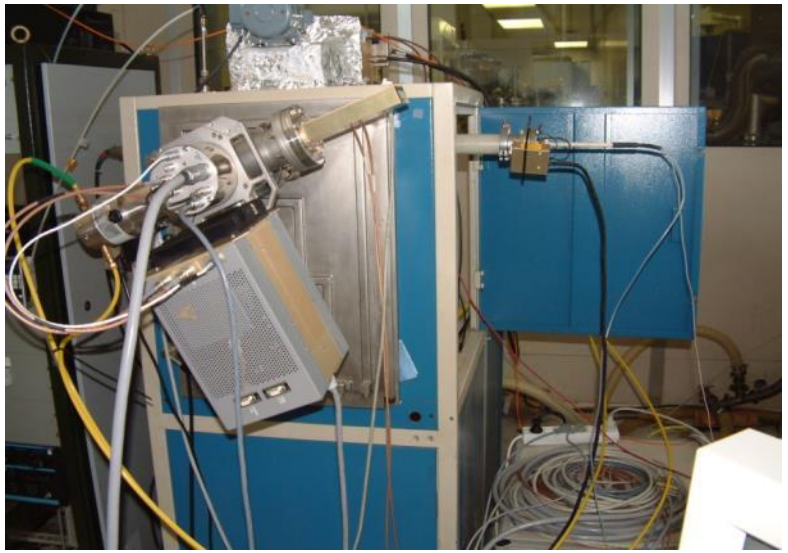
Limiting factors for customers:

- Personal, Know-How
- Measurement systems for the process characterisation
- Different PVD technologies

Research activities



EMPA – Dübendorf (CH)



CeTeV – Carsoli (I)

Research activities

IonBond – Newcastle (GB)

Setup of the plasma measurement

Scientific cooperation

Decorative Hardcoatings for frames
Company: Certottica, PhysTech, MCT
Hard coatings for injectors

Coating service: anti adhesion
Company: MedEl, PhysTech, MCT
Anti adhesion coatings for injection moulding

Scientific project: Ski technologies
Technologiezentrum Ski- und Alpinsport, ÖSV, Universität Innsbruck, PhysTech, Tyrolit, Wintersteiger, HWK Kronbichler
Hard coatings and anti friction surfaces

Scientific cooperation project: Flexible PV with CIGS
Sunplugged, PhysTech, MCT
Process optimisation and thin film characterisation

Qualification network: QualiMat
Uni Innsbruck, MCI, MCT, Tyrolean Industrial Partners
Education and qualification of employees in the field of material science

Thank you for your attention