

Environment-friendly and Cost-efficient Production of Functional Metal Oxide Films

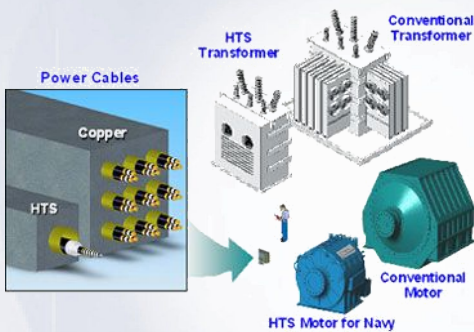
licensing opportunity:

Invention

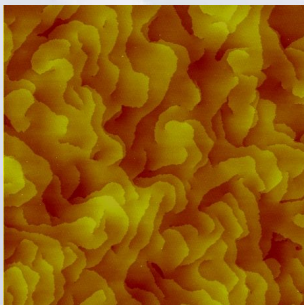
High-quality functional metal oxide films and metal oxide nanostructures are produced at ambient pressure using a budget-priced Metalorganic Aerosol Deposition technique. This technique is well suitable for continuous, e.g. reel-to-reel processes. Additional outstanding feature, notably in contrast to MOCVD, is the possibility to choose environment-friendly and budget-priced precursors .

Market

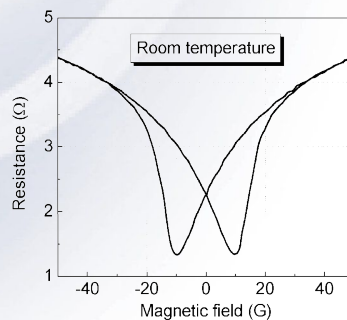
- **Magnetometers for medical devices:** \$350 million worldwide per year — manganite films produced with Göttingen process are appropriate to address this market.
- **LED for general illumination:** \$330 million in US, 2007; rapidly growing segment of \$40 billion worldwide general illumination market — ZnO-films or ZnO-nanostructures produced with Göttingen process are appropriate to address this market.
- **High temperature superconductors:** €500 million global market est. for 2013 including HTS power transmission cables — Göttingen YBCO films are well suited to address this market.
- **Biosensor devices:** \$7000 million global market in 2006 — ZnO is a key component of cantilever-based, surface acoustic wave, and nanostructure devices.



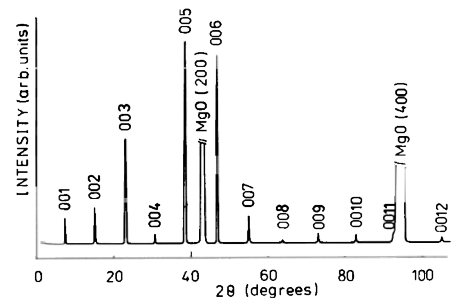
Proof of Concept



STM-image of LCMO/MgO (100), area = 0,9·0,9 μm², image rms = 0,299nm



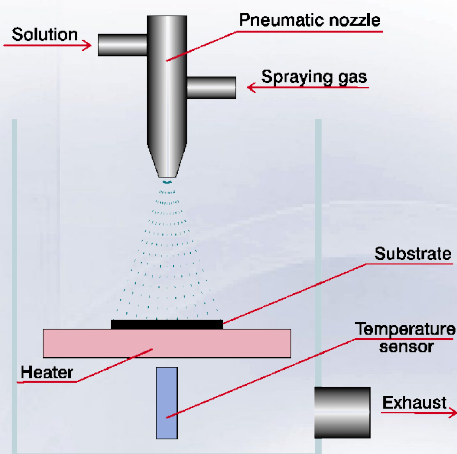
left: LSCMO as room temperature **low-field magnetometer**, excellent 100% resistance change at $\Delta B \approx 1$ mT (i.e. 10 G);



right: very sharp peaks illustrate high crystalline quality of **high temperature superconducting** YBCO film grown by Metalorganic Aerosol Deposition

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Technical Details



Sketch of principle; patented special features and details are not shown.

- Environment-friendly selection of precursors is possible as Göttingen Metalorganic Aerosol Deposition technique uses dispersed metalorganic aerosols which **remain unmixed up to the evaporation** very close to the substrate.
- Complex film compositions (stoichiometry) are **controlled by adjusting the flows** of the different metalorganic precursors.
- Depending on the type of substrate the films grow **epitaxially** with **perfect crystalline** structure and **tunable microstructure**.
- As carried out at **ambient pressure**, the technique is appropriate to implement continuous, e.g. reel-to-reel production processes.
- All mentioned films — magnetosensitive manganites *LSCMO* and *LCMO/MgO*, piezo-electric and semiconducting *ZnO*, high temperature superconducting *YBCO* — have been produced and qualified by divers characterization techniques, e.g. Scanning Tunneling Microscopy.

Comparison to State of the Art

- The Göttingen process is both more cost-efficient and more suitable to continuous, e.g. reel-to-reel processes, because Göttingen Metalorganic Aerosol Deposition works at ambient pressure, in contrast to standard MOCVD process, which generally is carried out at least at low vacuum (≤ 100 kPa).
- The Göttingen process can be set-up both environment-friendly and cost-efficient by choosing ecologically compatible and budget-priced precursors, in contrast to MOCVD, where in general very complex and expensive substances are needed.
- The Göttingen process is easier to implement and to configure, because there is no need for a gas handle system.

German Patent 10347119 granted.

Additional international patent application filed.

We are looking for a licence partner.