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**Combinatorial thin film materials science: From materials discovery and optimization to materials design**Jochen M. Schneider<sup>1</sup><sup>1</sup>Materials Chemistry, RWTH Aachen, Aachen, Germany

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This lecture provides an overview of modern materials development, from discovery and optimization towards materials design, based on combinatorial thin film materials science. The combinatorial approach, combining combinatorial materials synthesis of thin film composition-spreads with high-throughput property characterization has proven to be a powerful tool to delineate composition-structure-property relationships, and hence to efficiently identify composition windows with enhanced properties. Furthermore, and most importantly for materials design, theoretical models and hypotheses can be critically appraised. The combination of modern electronic structure calculations with the highly efficient combinatorial thin film composition-spread method constitutes an effective tool for knowledge based materials design of hard coatings, nanolaminates, thermoelectrics, metallic glasses and steel.

**Keywords**

materials  
materials design  
properties  
theoretical models