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Towards High-Throughput Studies of Gradient Multi-Component Thin Films

The technological progress of the last decades would not have been possible without the development of new materials. The materials with the best characteristics for applications are frequently complex multi-component systems with rather nontrivial composition-property dependencies. The compositional optimization of new materials calls for high-throughput studies with many different compositions probed to reveal the non-linear and non-monotonic dependencies. A key element for the high-throughput studies is a sample preparation technique resulting in suitable samples.
In this work, we propose a novel approach for preparation of multi-component molecular thin films with gradient distribution of components. An organic molecular beam deposition (OMBD) chamber, recently developed in our group, makes it possible to overcome unintentional variations in deposition conditions for different samples and, importantly, to obtain a film with a composition gradient in one run. The ultimate spatial resolution of modern sample characterization methods, such as surface-sensitive X-ray scattering or UV-Vis spectroscopy, allows probing the sample structure and properties at different spatial points along the gradient axis, thus effectively providing high compositional resolution. The preliminary structural and optical results from binary gradient films of organic semiconductors proof the effectiveness of the proposed approach.

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Instrumentation and methods

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