Atomic/Molecular Layer Deposition of Inorganic-Organic Carboxylate Network Thin Films for Possible Sensing Applications

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We introduce novel atomic/molecular layer deposition (ALD/MLD) processes for the fabrication of crystalline inorganic-organic coordination network thin films with different s-block elements and different aromatic polycarboxylates. The deposition processes fulfill the basic principles of ALD/MLD-type growth including the sequential self-saturated gas-surface reactions and atomic/molecular-level control of the film thickness, and yield crystalline thin films in a wide deposition temperature range. We have investigated the stability of the films in heat and humidity treatments to verify that some of the films reversibly absorb water molecules forming well-defined crystalline water-derivative phases. This suggests that the materials could be utilized e.g. for gas storage and sensing applications. Also interestingly, for some of our as-deposited crystalline thin-film materials there are no bulk structures reported in literature. Our work thus underlines the strength of the ALD/MLD technique in discovering new exciting coordination network thin-film materials that may ultimately be potential material candidates for the next-generation application in, e.g., electronics, sensors, and other high-technology products.

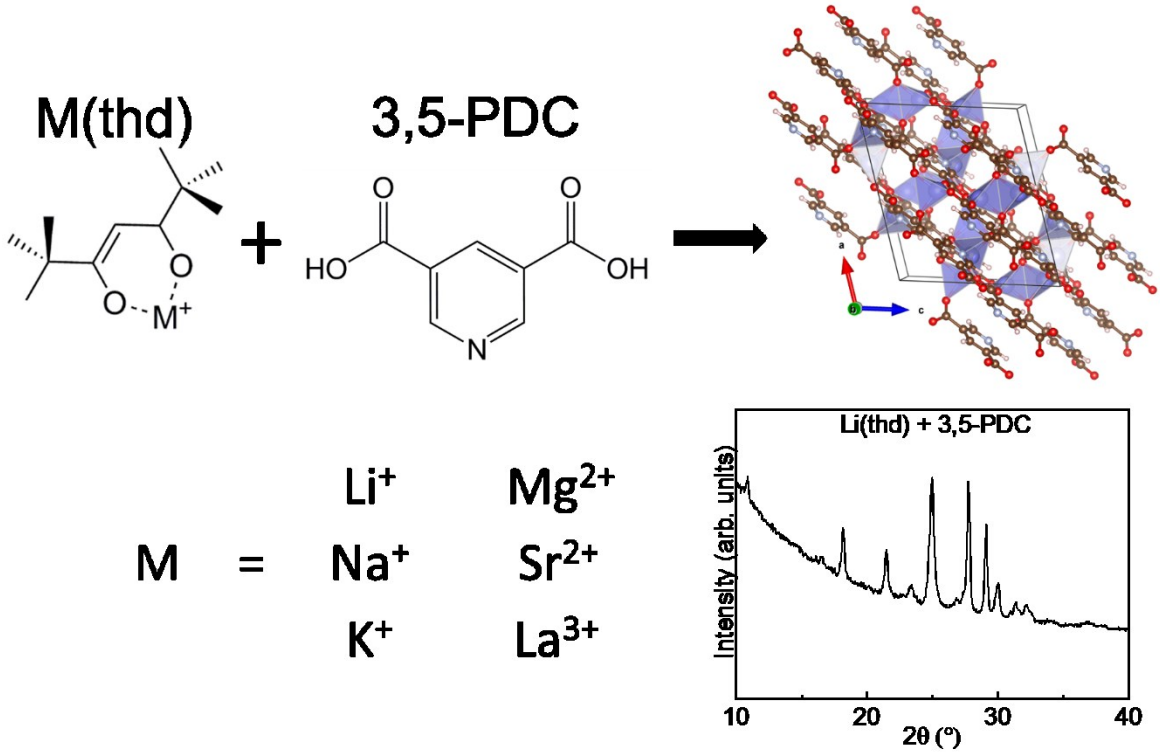

Figure 1. Fabrication process of crystalline inorganic-organic thin films based on different s-block elements and lanthanum with 3,5-pyridinedicarboxylic acid as the organic precursor.

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2. Ahvenniemi, E. & Karppinen, M. In Situ Atomic/Molecular Layer-by-Layer Deposition of Inorganic–Organic Coordination Network Thin Films from Gaseous Precursors. *Chem. Mater.* **28,** 6260–6265 (2016).
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