

Molecular beam epitaxy of palladates with square-planar coordinated palladium

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The structural pattern of a planar coordinated transition metal ion is a scarcity and such a coordination type has been known for Ni^{2+} , Cu^{2+} , Cu^{3+} , Pd^{2+} , Pt^{2+} , and Au^{3+} . Amongst them Cu^{2+} is known to form infinite corner-sharing networks resulting in the Nd_2CuO_4 structure which is a high T_c superconductor. Similarly, Pd^{2+} can be stabilized as well in the Nd_2CuO_4 structure type, though electronic correlations of Nd_2PdO_4 have not been investigated by single crystals. Here we report on the synthesis of epitaxially grown thin films of $\text{Nd}_{2-x}\text{Ce}_x\text{PdO}_4$ by reactive molecular beam epitaxy. We find that the formation of edge-sharing PdO_2 plaquettes is in competition to other coordinations of palladium, i.e., $\text{Nd}_2\text{Pd}_2\text{O}_5$ and Nd_4PdO_7 . Moreover, thermodynamic constraints are imposed to the synthesis of $\text{Nd}_{2-x}\text{Ce}_x\text{PdO}_4$ as decomposition into $\text{PdO} + \text{Nd}_2\text{O}_3$ or $\text{Pd} + \text{Nd}_2\text{O}_3$ are determined by the synthesis temperature. Eliminating the thermodynamically favorable phase of Nd_4PdO_7 by diligently controlling the stoichiometry and the oxidizing conditions during the synthesis is paramount for the growth of single crystalline thin films of $\text{Nd}_{2-x}\text{Ce}_x\text{PdO}_4$.