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_{2}CuO_{4} structure which is a high T_{c} superconductor. Similarly, Pd^{2+} can be stabilized as well in the Nd_{2}CuO_{4} structure type, though electronic correlations of Nd_{2}PdO_{4} have not been investigated by single crystals. Here we report on the synthesis of epitaxially grown thin films of Nd_{2-x}Ce_{x}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., Nd_{2}Pd_{2}O_{5} and Nd_{4}PdO_{7}. Moreover, thermodynamic constraints are imposed to the synthesis of Nd_{2-x}Ce_{x}PdO_{4} as decomposition into PdO + Nd_{2}O_{3} or Pd + Nd_{2}O_{3} are determined by the synthesis temperature. Eliminating the thermodynamically favorable phase of Nd_{2}PdO_{2} by diligently controlling the stoichiometry and the oxidizing conditions during the synthesis is paramount for the growth of single crystalline thin films of Nd_{2-x}Ce_{x}PdO_{4}.