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論文題目：Epitaxial Growth, Structural Characteristics, and Electronic States of Ytterbium Pnictides
イッテルビウムニクタイドのエピタキシャル成長、構造特性および電子状態

Rare-earth pnictides (*REPn*s) are well known for their diverse magnetic and electronic properties originating from strongly localized 4*f* electrons [1,2]. In recent years, thin-film growth by molecular beam epitaxy (MBE) under ultra-high-vacuum conditions has emerged as a practical approach for fabricating high-quality single crystal samples of *REPn*s, particularly *RE*Ns [3-5] and *RE*Sbs [6,7]. However, the epitaxial growth of ytterbium-based pnictides remains challenging. Because Yb is unable to catalyze the dissociation of N_2 molecules, unlike many other rare-earth elements, an activated nitrogen source is required for the MBE growth of YbN [8]. As a result, epitaxial YbN thin films have not been reported to date. Meanwhile, Yb ions can adopt either divalent or trivalent states, giving rise to multiple Yb–Sb compounds with different stoichiometries [9]. So far, however, reports on Yb–Sb thin films have been limited to $YbSb_2$ [10], while thin films of other ratios between Yb and Sb remain unexplored.

In this study, we successfully fabricated high-quality single-crystalline YbN thin films for the first time using nitrogen-plasma-assisted MBE [11]. Photoelectron spectroscopy (PES) reveals that Yb ions are in a purely trivalent state and that YbN is semiconducting. Also, evidence of hybridization between the Yb 4*f* and N 2*p* states is found [12].

Meanwhile, a systematic growth study of Yb-Sb thin films was carried out, in which epitaxial growth of divalent compounds was achieved under both Yb-rich ($Yb_{11}Sb_{10}$) and Sb-rich ($YbSb_2$) conditions, while trivalent YbSb could not be synthesized. This could be attributed to the weaker electron affinity of Sb compared with lighter pnictogen elements, which is insufficient for the unstable trivalent Yb ions.

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