Electronic localization in $CaVO_3$ films via bandwidth control

D.E. McNally et al, npj Quantum Materials 4, 6 (2019)
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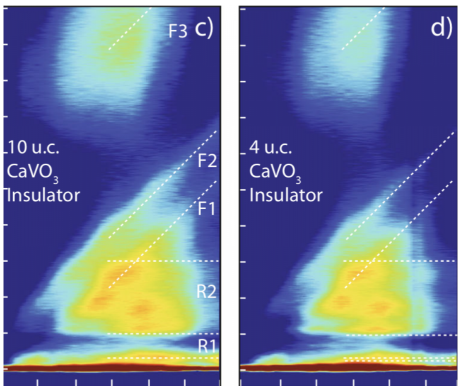

Understanding and controlling the electronic structure of thin layers of quantum materials is a crucial first step towards designing heterostructures where new phases and phenomena, including the metal-insulator transition (MIT), emerge. Here, we demonstrate control of the MIT via tuning electronic bandwidth and local site environment through selection of the number of atomic layers deposited. We take $CaVO_3$, a cor related metal in its bulk form that has only a single electron in its V^{4+} 3d manifold, as a representative example. We find that thick films and ultrathin films (≤6 unit cells, u.c.) are metallic and insulating, respectively, while a 10 u.c. $CaVO_3$ film exhibits a clear thermal MIT. Our combined X-ray absorption spectroscopy and resonant inelastic X-ray scattering (RIXS) study reveals that the thickness-induced MIT is triggered by electronic bandwidth reduction and local moment formation from V^{3+} ions, that are both a consequence of the thickness confinement. The thermal MIT in our 10 u.c. $CaVO_3$ film exhibits similar changes in the RIXS response to that of the thickness-induced MIT in terms of reduction of bandwidth and V 3d–O 2p hybridization.

Read more: https://www.nature.com/articles/s41535-019-0146-3

Revealing the role of microstructure architecture on strength and ductility of Ni microwires by in-situ synchrotron X-ray diffraction

Ravi raj purohit Purushottam raj purohit et. al, Scientific Reports 9, 79 (2019)
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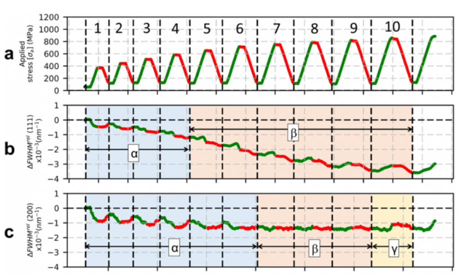

The objective of this work is to understand strengthening and reduction of ductility in nickel microwires with reduction in diameter via high-energy synchrotron X-ray diffraction (XRD). Tensile tests on Ni microwires are performed in combination with XRD to derive the deformation mechanisms taking place in the different grain families. These mechanisms are discussed in view of the initially observed microstructure (grain size and crystallographic micro-texture) and the effect of diameter change by electropolishing. From these results, guidelines are proposed to tailor the strength and ductility of Ni microwires, these considerations being general enough to be extended to other FCC metals.

Read more: https://www.psi.ch/pem/revealing-the-role-of-microstructure-architecture-on-strength-and-ductility-of-ni-microwires-by-in-situ-synchrotron-x-ray-diffraction

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