Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Finding a metallic chain in strained monoclinic VO_2 films. TETIANA SLUSAR, ETRI, JIN-CHEOL CHO, University of Science and Technology, HYANG-ROK LEE, KI-JU YEE, Chungnam National University, HYUN-TAK KIM, ETRI — The microscopic understanding of the electron-electron and electron-phonon interplay is crucial for describing the physics of the insulator-to-metal transition (IMT) in VO_2 and other strongly correlated systems. The clue on this in VO_2, particularly, was obtained when the second monoclinic insulating M2 phase was discovered. It is an intermediate phase between monoclinic insulating M1 and rutile metallic R emerging when VO_2 undergoes structural changes accompanying the IMT. The M2 phase with its two substructures of V-atoms arrangement, a charge-density wave (CDW) and antiferromagnetic insulator-chain (IC), enables the electronic Mott transition via transformation of the IC into a metallic chain (MC) through a breakdown of the electrons correlations. However, the MC has been never observed experimentally. We resolve this issue via the separation of coherent optical phonons originating from different M2 substructures with a subsequent IC-to-MC transformation on IMT. It was measured by ultrafast pump-probe technique that is a unique tool able to sense both structural changes on a femtosecond timescale and the corresponding response of electronic system. This finding decouples the electron-electron and electron-phonon contribution, supporting the Mott IMT.

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Date submitted: 31 Oct 2016 Electronic form version 1.4