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Proton Irradiation Influence on Metal-Insulator Transition of VO2

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The impact of proton irradiation on the metal-insulator transition (MIT) of Vanadium dioxide (VO_2) was investigated through in-situ X-ray absorption fine structure (XAFS) and electrical resistance measurements. VO_2 films, approximately 100 nm thick, were fabricated using DC-sputtering deposition techniques. Protons with energies of 100 and 200 keV and fluxes of 10^14 and 10^16 protons/cm² were vertically irradiated at KOMAC. A pristine VO_2 film exhibited the MIT at approximately 72.5℃ during heating. The transition temperature (Tc) of proton-irradiated VO_2 films with 100 keV energy and 1014 protons/cm² flux was around 75℃, while for the same energy but with 10^16 protons/cm² flux, it was 52.5℃. The Tc of the proton-irradiated VO_2 film with 200 keV energy and 10^13 protons/cm² flux was 77.5℃. XAFS measurements at the V K edge revealed the presence of V-V dimers in all VO_2 films in the metallic phase. The XAFS analysis indicated significant differences in the local structural properties around the V atom in the proton-irradiated VO_2 films, compared to the pristine VO_2, potentially influencing the Tc of VO_2. This study highlights the potential of proton irradiation techniques in tailoring the transition temperature of VO_2 films.

Paper submission Plan

No

Best Presentation

Yes

Contribution track

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