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Collapse of the low temperature insulating state in Cr-doped V_2O_3 thin films PIA HOMM, LEANDER DILLEMANS, MARIELA MENGHINI, BART VAN BILZEN, PETAR BAKALOV, CHEN-YI SU, RUBEN LIETEN, MICHEL HOUSSA, JIN WON SEO, JEAN-PIERRE LOCQUET, KU Leuven, DAVOUD NASR ESFAHANI, LUCIAN COVANI, FRANCOIS PEETERS, University of Antwerp — We have grown epitaxial Cr-doped V_2O_3 thin films with Cr concentrations between 0 and 20% on (0001)-Al_2O_3 by oxygen-assisted molecular beam epitaxy. For the highly doped samples ($> 3\%$), a regular and monotonous increase of the resistance with decreasing temperature is measured. Strikingly, in the low doping samples (between 1% and 3%), a collapse of the insulating state is observed with a reduction of the low temperature resistivity by up to 5 orders of magnitude. A vacuum annealing at high temperature of the films recovers the low temperature insulating state for doping levels below 3% and increases the room temperature resistivity towards the values of Cr-doped V_2O_3 single crystals. It is well known that oxygen excess stabilizes a metallic state in V_2O_3 single crystals. Hence, we propose that Cr doping promotes oxygen excess in our films during deposition, leading to the collapse of the low temperature insulating state at low Cr concentrations. These results suggest that slightly Cr-doped V_2O_3 films can be interesting candidates for field effect devices.

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