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S. V. Kalinin

sergei2@ornl.gov

V. Meunier

meunierv@ornl.gov

E. W. Plummer

eplummer@utk.edu

J. Guo

jguo1@utk.edu

Rob G. Moore

rgmoore@utk.edu

A. P. Baddorf

baddorfap@ornl.gov

Defect Ordering on the Surface of Layered Strontium Ruthenates *

S. V. Kalinin^a, V. Meunier^a, E. W. Plummer^{a,b}, J. Guo^b, Rob G. Moore^b,
and A. P. Baddorf^a

^a Oak Ridge National Laboratory, ^b University of Tennessee

Surfaces of layered strontium ruthenates, Sr_2RuO_4 and $\text{Sr}_3\text{Ru}_2\text{O}_7$, exhibit an array of defects after cleaving in vacuum which have been observed using atomic resolution scanning tunneling microscopy (STM).¹ At room temperature, surface defects are randomly distributed, but are surprisingly ordered at below 200 K and form extended lines, which on $\text{Sr}_3\text{Ru}_2\text{O}_7$ produce a new super-lattice structure with a periodicity of 1.3 nm. We identify these defects for the first time as a pair of missing atoms: SrO. This idea is supported by the observation of SrO desorption from SrRuO_3 during heating. First principles calculations compare removal of this neutral pair to removal of a single atom and simulate the observed STM images. The missing SrO pair leaves a surface defect with an effective dipole moment which provides the interaction producing alignment at low temperatures.

. ¹E. W. Plummer, Ismail. R. Matzdorf, A. V. Melechko. and Jiandi Zhang, Prog. Surf. Sci., 67, 17 (2001)

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