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Domain Boundaries and Defect Structures in 2D Insulating Silica Bilayers[1] K. M. BURSON, Hamilton College, Clinton, NY, C BÜCHNER, M HEYDE, H.-J. FREUND, Fritz-Haber Institute of the Max Planck Society, Berlin, Germany — Two-dimensional (2D) materials present an exciting route towards tailored nanoelectronics. Bilayer silica, a wide band-gap two-dimensional insulator, has recently been added to the toolbox of 2D materials for van der Waals heterostructures [1]. Bilayer silica can be grown in crystalline and amorphous forms and successful transfer of a mm-scale film has been demonstrated. In their crystalline form, silica bilayers feature various defect structures. Here we present a scanning tunneling microscopy study with atomic resolution of grain boundaries in silica bilayers grown on Ru(0001) [2]. Tilt boundaries consisting of 5- and 7-membered rings and antiphase boundaries consisting of 5- and 8-membered rings are observed in addition to Stone-Wales defects and closed-loop boundaries. The influence of the Ru(0001) substrate is discussed and comparisons between grain boundary structures and amorphous silica structures are drawn based on ring-size statistics and local structural motifs. We conclude that the structure of domain boundaries in bilayer silica is distinct from the amorphous phase due to a high degree of order and periodicity. [1] C. Büchner, et al. ACS Nano 10, 7982 (2016). [2] K. M. Burson, et al. J. Phys. Condens. Matter (accepted).

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