A Pseudo-2D “Zigzag” Silica Polymorph on a Metal Support

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In recent years the growth and characterization of silica thin film networks has become a research topic on its own [1]. These film have revealed due to its two-dimensional (2D) flatness the atomic structure of the most prominent glass former, namely silicon dioxide. Furthermore, the silica bilayer is a new 2D material with a wide band gap, high stability under ambient conditions and transferability from one substrate to another one. These long-wanted properties in 2D materials allow now for a wide variety of technological applications.

Therefore, knowledge about its growth modes, transformations and dynamics of these silica films is of great importance. Here we would like to present a new silica polymorph with a characteristic “zigzag” line structure and a rectangular unit cell. Such films have been grown and studied on single-crystalline Ru(0001) substrates.

Based on scanning tunneling microscopy, low energy electron diffraction, infrared reflection absorption spectroscopy and x-ray photoelectron spectroscopy measurements together with density functional theory calculations a structural model for the “zigzag” polymorph is proposed [2].

The structure of this film combines elements from the established monolayer and bilayer silica films. Three-membered silica rings are connecting interface elements, leading to corrugated surface structure. The existence of three-membered rings has been expected but never found so far in flat 2D films, which comprise of 4 to 10 membered silica rings. This polymorph provides insight for structural transformations of ultra-thin silica films.

References:
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[2] D. Kuhness, H. J. Yang, H. W. Klemm, M. Prieto, G. Peschel, A. Fuhrich, D. Menyel, T. Schmidt, X. Zu, S. Shaikhutdinov, A. Lewandowski, M. Heyde, A. Kelemen, R. Włodarcyzk, D. Usvyat, M. Schütz, J. Sauer, H.-J. Freund, submitted.