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The deoxidation of silicon surface using strontium oxide deposited with the PLD technique

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The epitaxial growth of functional oxides on silicon substrates requires atomically defined surfaces, which are most effectively prepared using Sr-induced deoxidation. Since the manipulation of metallic Sr is very delicate we investigated the applicability of the chemically much more stable SrO in the process of native-oxide removal and silicon-surface stabilization using the pulsed-laser deposition technique (PLD). For that purpose we have examined the effect of PLD conditions, such as deposition atmosphere, number of pulses, temperature, deposition rate, mask size and fluency, on SrO-induced deoxidation of silicon surface. The as-derived surfaces were analyzed in situ using reflection high-energy electron diffraction and ex situ using X-ray photoelectron spectroscopy, X-ray reflectivity and atomic force microscopy. The results are showing that careful control of PLD experimental conditions, especially temperature and the amount of SrO, play the critical role in the optimization of deoxidation process. The results of study reveal an effective pathway for the preparation of smooth, 2×1 Sr-reconstructed silicon surface which can be used for integration of functional oxides on silicon substrate.

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Reliable low-cost experimental setup for material synthesis modification by applying alternating electric fields

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Building of laboratory hardware in-house can reduce overall equipment costs and respond to the specific requirements of the experiment. The aim of this contribution is to present the novel design and implementation of the low-cost module for AC electric excitation of chemical systems, mainly intended for modifying wet chemical synthesis of nanomaterials. Results of preliminary modelling and experimental tests indicate good module reliability and applicability of the modification methodology on various material types (ceramics, metals and proteins). Possible underlying mechanisms correlating the influence of alternating electric fields and material properties, as well as potential improvements in module construction are discussed.