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Structural and chemical analysis of coexisting hexagoal and monoclinic phases of samarium oxide on Cu(111) — Björn Riedel, Lars Buss, Raquel Sanchez-Barquilla, and Jan Ingo Flege — Applied Physics and Semiconductor Spectroscopy, Brandenburg University of Technology Cottbus-Senftenberg, Germany

The absence of in-depth spectroscopic and structural studies on model systems leads to a knowledge gap in understanding how the structure of samaria influences its chemical behavior. A multi-method approach has been employed to investigate the Cu(111)-supported Sm_2O_3 surface with high structural and chemical sensitivity by using low-energy electron microscopy (LEEM) in combination with X-ray absorption photoemission electron microscopy (XAS-PEEM) and other complementary methods such as micro-spot low-energy electron diffraction (μLEED) and X-ray photoelectron spectroscopy (XPS). Our measurements show the phase coexistence of small hexagonal A-Sm_2O_3(0001) islands and monoclinic B-Sm_2O_3(100) rectangular-shaped islands with different rotated rectangular domains. Furthermore, the redox properties of both Sm_2O_3 phases were studied by exposing the system to reducing (H_2) and oxidizing (CO_2) conditions, indicating a face-dependent reduction and oxidation behavior. Moreover, the monoclinic Sm_2O_3(100) islands appear less stable as they change to the hexagonal phase during annealing. These results indicate a highly dynamic system that can easily be adjusted by adapting the growth conditions, such as growth temperature and oxygen partial pressure.

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