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Oxidation of the Alkali-Metal induced Ge(111)-3×1 Surfaces

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It is well known that adsorption of alkali metals (AMs) on both metal and semiconductor surfaces enhances the surface oxidation. Against this expectation, however, a surface passivation rather than enhanced oxidation was reported for a Si(111)-3×1 surface induced by Na adsorption at elevated temperature. The AM-induced 3×1 surface reconstruction occurring not only for Si(111) but also for Ge(111) is known to adopt a common structure, regardless of the metal species. However, we found using core-level photoemission and Auger electron spectroscopy that the reactivity towards oxidation of the AM-induced Ge(111)-3×1 surfaces differs significantly for different metals despite the common substrate reconstruction structure. Compared with the case of the Ge(111)-c(2×8) surface, the oxidation of the Ge(111)-3×1 surface is significantly suppressed for Na and K adsorbates, but greatly enhanced for Li adsorbate. The enhanced oxidation of the Li/Ge(111)-3×1 surface is not only against the notion that the common alkali-metal induced 3×1 reconstruction passivates the surface. The origin of the difference in surface reactivity of the alkali-metal induced Ge(111)-3×1 surfaces will be discussed.