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**SURFACE X-RAY DIFFRACTION STUDY OF Cu UPD ON Au(111) ELECTRODE IN 0.5M H₂SO₄ SOLUTION**

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The structure of UPD copper, a hydration water molecule, and a bisulfate anion on Au(111) surface in 0.5M H₂SO₄ solution has been determined by in-situ surface X-ray diffraction study. The X-ray data collection was carried out at the synchrotron facility of SPring-8 at beam line 09XU. The bisulfate anion and the UPD copper form a v3xv3R30 structure on an Au(111) electrode at a potential between 250 and 400 mV. At this potential range, UPD Cu, a bisulfate anion, and a hydration water molecule coadsorb on Au(111), while the coverages of copper and bisulfate anion are 2/3 and 1/3, respectively. The co-adsorption structure is represented by the symmetry of P31m. Bisulfate anion forms C3v symmetry and is accommodated in a copper honeycomb center on Au(111) surface. On top of each copper atom, a hydration water molecule is accommodated to form a stable and closest-packed water coplanar adlayer with a large density. The distance (OH...O), 2.88 Å, is typical of the hydrogen-bonding value seen in an ice structure under high pressure. The new water phase is formed by a closely packed oxygen of 1x1 with a coplanar layer. At a more positive potential than 940 mV, the bisulfate anion forms a v3xv7 structure on a copper free Au(111) surface, while at a more negative potential than 250 mV, the v3xv3 structure is retained on 1x1 Cu/Au(111) surface.

**Keywords:** ELECTRODE SURFACE UNDERPOTENTIAL DEPOSITION HYDRATION

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**KINEMATICAL X-RAY SCATTERING THEORY OF SELF-ASSEMBLED QUANTUM DOT ARRAYS AND SUPERLATTICES**

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Self-assembled quantum dots (SADs) are the subject of intense investigation as they offer carrier confinement in all three dimensions, an important feature for various applications, particularly in optoelectronics. The fact that the optoelectronic properties of the SADs strongly depend on the shape and size distribution of the dots as well as on interface mixing and, in the case of Stranski-Krastanow growth, on the properties of the wetting layer (WL) motivates the development of non-destructive characterization techniques. We have recently observed that InAs SAD arrays embedded in InP(001) under various growth conditions can yield essentially identical high-resolution x-ray diffraction (HRXRD) scans near Bragg reflections while their x-ray reflectivity (XRR) signatures are markedly different. However, standard roughness models in XRR calculations are incompatible with well-separated SADs embedded in a matrix. A kinematical x-ray scattering model incorporating the effects of the dot shape, strain-state, spatial distribution, WL thickness and x-ray coherence length on the scattering signal will be presented. Each parameter yields a different signature in the reciprocal space. In particular, we show how the variation of the incident beam coherence length, through the use of different monochromator systems, allows to control the volume for coherent scattering and thus to determine the SADs spatial distribution. Furthermore, our model indicates that it is possible to determine the quantum dots height and the wetting layer thickness independently from a combination of specular and non-specular scans along the reciprocal direction perpendicular to the sample surface.

**Keywords:** SELF ASSEMBLED QUANTUM DOTS, X-RAY DIFFRACTION, X-RAY REFLECTIVITY