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## 【研究成果：2002年度】

In this year, a significant development took place in our continuing project on the high-index surfaces of group IV semiconductors. Collaborating with Professor Lagally at University of Wisconsin-Madison and Professor Terakura's group at AIST, we successfully determined the structure of the Ge(105) surface, which is known as the side facet of Ge quantum dot structure on Si(001) studied intensively in this decade (1, 2). We clarified that this surface has a strained structure which can be relaxed by the lattice mismatch strain between overlayer Ge and substrate Si. This work was presented as an invited talk in Symposium on Surface Physics 2003 (SSP '03) as the paper was published, indicating its quick recognition among the surface science field. We also continued basic researches on high-index Si surfaces collaborating with Prof. Yang's group at Peking University, which contributed much for our understanding of the instability of the Si(105) surface before the deposition of Ge on it to fabricate the Ge(105) surface (3).

We also started a project on the fabrication of molecular nanostructure on semiconductor surface. We found that fluorinated C<sub>60</sub> molecules deposited on the Si(111)-7x7 surface "print" fluorine atoms on the surface to make locally fluorinated surface around the molecule (4). The STM observation of the etching process of the Si(111)-7x7 surface by the fluorine atoms printed by fluorinated C<sub>60</sub> molecules revealed that a significant diffusion process of fluorine takes place before the etching proceeds on the surface (5).

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4. FUJIKAWA Y., SADOWSKI J.T., KELLY K.F., NAKAYAMA K.S., MICKELSON E.T., HAUGE R.H., MARGRAVE J.L., SAKURAI T.

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5. FUJIKAWA Y., SADOWSKI J.T., KELLY K.F., NAKAYAMA K.S., NAGAO T., SAKURAI T.  
Fluorine etching on the Si (111)-7x7 surfaces using fluorinated fullerene  
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**【研究成果 : 2003 年度】**

Our work on the Ge(105) surface published in the previous year continuously received much attention and was presented as invited talks in American Physical Society March Meeting 2004 and several other international conferences in surface science and nanostructure fields.

In the meantime, we concentrated on the atomic-level characterizations of the metal-semiconductor interface in this year. We found a two dimensional gas phase of alkali metal formed on the Si(111)-7x7 surface, which transforms to the cluster-formation phase by the increase of the alkali-metal coverage (1). This work was presented as an invited talk in International Symposium on Physical Chemistry of Surface Nanostructures and Related Nanomaterials, indicating its high-level recognition. The initial formation process of Ag layers on the GaN surface was also investigated to document that the Ag growth can proceed in the layer-by-layer manner, which is desirable for the fabrication of uniform contact to the GaN surface (2, 3). In addition to these works, we also started to investigate the stability and initial growth process of semimetallic Bi on the Si(111)-7x7 surface motivated by the unique electronic property of Bi (4, 5). We found an interesting structural transition by the increase of Bi coverage to obtain well connected Bi layer after finishing the transition at the higher coverage range. Annealing of this Bi film resulted in the formation of perfectly connected Bi layer with large domain size, which seems suitable for the growth template of molecular materials because of the low reactivity of Bi surface.

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