Structure analysis of $BaTiO_3$ /Pt (111)/Si quascicrystal thin film by photoelectron diffraction

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In recent years, Förster *et al* have found that $BaTiO_3$(BTO) (111) islands spread on Pt(111) bare substrate were making 2D-Oxide quasicrystal (OQC) layer, which have twelve symmetry by UHV annealing (at ~1113 K) [1][2]. The discovery of quasicrystals with perovskite-type metal oxides raises the possibility of incorporating various physical properties of perovskite compounds into quasicrystals. In previous work [1], a clear energy shift between BTO (111) (Ti^{4+}) and OQC state (Ti^{3+}) has been confirmed in Ti 2*p* photoelectron spectra. Furthemore, STM pattern showed that Ti has a unique structure of quasicrystal[1]. However, the atomic arrengements and electronic staes of Ba and O in OQC states have not been clarified yet.

In this study, we tried to take photoelectron diffraction (PED) from Ba and O atoms in OQC state by using our high energy resolution photoelectron diffraction analyer ``DELMA`` (*Display-type ELlispoidal Mesh Analyzer*) (Figure 1)[3]. Figure 2 is PED results of O 1*s* and Ba *MNN* Auger after O_2 annealing.This annelaing condition should produce BTO (111) island and we have confirmed BTO (111) rich spots by RHEED. Suprisingly, the observed patterns were totally different from Pt 4*f* pattern from Pt(111). Figure 3 shows PEDs after UHV annealing (T_{anneal} = 1113 K), which should produce OQC. There are clear additional peaks both in O 1*s* and Ba *MNN*. Furthermore, RHEED and XPS showed OQC like suface which are clearly different from BTO (111) ilands. We need to pick up pure OQC pattern from these results. We will discuss more details in the poster session.

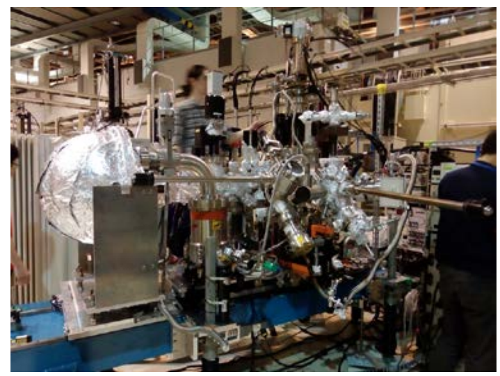
Fig.1 DELMA @ BL07LSU SPring-8

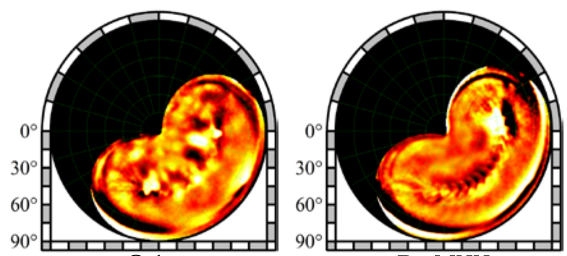

Fig.2 PEDs from BTO(111) (T_{anneal} = 913*K*)

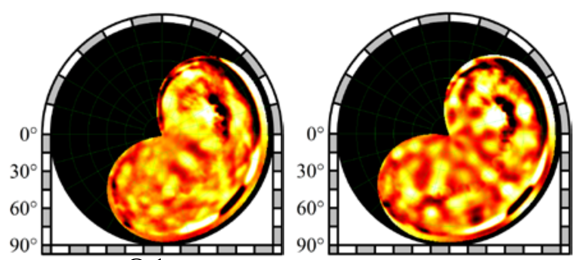

Fig.3 PEDs from OQC surface (T_{anneal} = 1113*K*).

References
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[3] Hiroyuki Matsuda, Hiroshi Daimon, Phys. Rev. E, **71**, 066503 (2005).