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ROLE OF THE DEFECTS IN CREATION OF THE CLUSTERS ON COMPOSITE OXIDE Sn$_{(y)}$O$_x$ THIN FILMS SURFACE

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Thin oxide film has been attracting the interests of scientists and technologists because of its wide applications in many fields . Specially, it is applied in making gas sensors, which can be employed widely to detect toxic or inflammable gases. In these sensors, clusters play a role as catalytic activators in which they can enhance the gas sensitive properties of the sensors. Size and shape of the clusters, which were created in preparation process, depend strongly on doped materials [y in the formula Sn$_{(y)}$O$_x$]. However, up to now the cause of creation of clusters in composite oxide Sn$_{(y)}$O$_x$ has not been interpreted yet. In this work, we report a new result, which we recently achieved by using the high resolution electron microscope in study the material. We excavated many 'islands' in Sn$_{(y)}$O$_x$ thin film . The sizes of these 'islands' are extremely small, approximately of \$5 Å o\$ or less. There are also zigzagging linien around it. In our opinion, there are defects around these 'islands'. The energy of these defects created changes the structure around 'islands'. These changes thus, are presented by the zigzagging linien. The zigzagging linien are considered as germs to create clusters in materials. Therefore we can conclude, defects play an important role in creation of clusters on the composite oxide Sn$_{(y)}$O$_x$ thin films surface.

Keywords: SMALL ISLANDS, ZIGZAGGING LINIEN, CLUSTER

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DEFECTS IN QUASICRYSTALS INVESTIGATED BY COHERENT BEAM X-RAY IMAGING

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Quasicrystals, which do not exhibit three-dimensional long-range periodicity, but just display a long-range translational and rotational order, are capable of producing sharp diffraction patterns with peak widths comparable to that of the best metallic crystals. To be able to interpret the intriguing properties of quasicrystals, in connection with their unusual structure, one has to know their defects. Theory shows that the strain field around quasicrystal defects can be considered as split into two components of a periodic hyperspace. The 'phonon' strain field in the physical subspace E∥ is similar to the one known from crystals, whereas the 'phason' strain field in the perpendicular subspace E is specific for quasicrystals.

The combination of X-ray diffraction topography and phase contrast radiography, possible when using a beam generated by a modern, high-energy, third generation synchrotron radiation source, is the most suitable approach to study the defect structure of quasicrystal samples on a macroscopic scale (in contrast to electron microscopy or X-ray diffuse scattering). We carried out a systematic study of typical defect images in various single grains of icosahedral Al-Pd-Mn quasicrystals. Our observations can be basically related to three kinds of defects. Firstly, those attributed to pores, and exhibiting a structure similar to that of spherical precipitates in crystals. Secondly, those of platelet-like or more spherically shaped approximant phases imbedded in the quasicrystal matrix. Thirdly, loop shaped images probably related to phason strain generated by quasicrystal inclusions or domains.

Keywords: **DEFECTS, QUASICRYSTALS, X-RAY IMAGING**

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X-RAY TOPOGRAPHIC OBSERVATIONS OF BONDED SILICON-ON-INSULATOR WAFERS USING SYNCHROTRON RADIATION

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The silicon-on-insulator (SOI) wafers are promising semiconductor materials for leading edge devices such as low power and high speed large-scale integrated circuits. Recently the crystalline quality and thickness controllability of the top silicon layer have been advanced, but their characterization technique is lagging because of the difficulty to observe ever so thin thickness of the top silicon layer. We attempted to characterize the SOI wafer by X-ray topography using the synchrotron radiation that generates extremely high-intensity X-rays as compared with the conventional X-ray source.

The samples used in this study were prepared by bonding two CZ Si(001) wafers in which the top silicon layer rotated 5 degree around the surface normal direction to avoid overlaying of the topographic images. The synchrotron white and monochromatic X-ray topographic measurements were carried out at beam line 28B2 of SPring-8/ Hyogo, Japan.

We observed a wrinkled pattern in the transmission white X-ray topograph from the top silicon layer, while it was not observed for the substrate. This indicates the existence of the irregularity in the top silicon layer. The average period of the wrinkles was a few tens of micrometers. In the monochromatic topographs, similar patterns were observed and its contrast reversed by rotating the sample by about 10 arcsec. These results mean that there exist distributed small regions with slightly deviated crystallographic orientation in the top silicon layer. Furthermore, we observed the similar pattern in the topographs from the state-of-the-art SOI wafers with the top silicon layer of less than 100 nm thick.

Keywords: **SILICON-ON-INSULATOR SYNCHROTRON X-RAY TOPOGRAPHY BONDED WAFER**

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X-RAY IMAGING AND FERROELECTRIC SWITCHING STUDIES OF HIGH POTASSIUIM DOPED KTiOPO$_4$

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Ferroelectic crystals such as KTiOPO$_4$ (KTP), KTiOAsO$_4$ are of interest because of their importance in non-linear optical frequency conversion. They can be periodically poled on the scale of microns. Recently, the mechanism of the poling has become of interest and, by using the new technique of “Bragg-Fresnel” imaging (1) provides a unique way to investigate, in the bulk, the produced lateral superstructure. This implies using a coherent synchrotron radiation beam at station ID19, ESRF. The results for both [100] and [010] poled high potassium doped KTP (HKKTP) are presented here. The conventional [100] poled HKKTP gives rise to phase contrast images arising from a phase jump due to the difference in structure factors across the domain wall. By comparing this phase jump with the theoretical predictions of various models for the domain walls, detailed atomic-level information has been obtained (2). The unconventional [010] poled HKKTP also gives rise to “black dots” on the topographic images that we infer show the poling history and the propagation of the switching charge. This will be confirmed by stroboscopic experiments, which will concentrate, by coupling x-ray diffraction imaging with a pulsed application of an electric field, on the *in situ* poling of these materials. These experiments will help to elucidate the general principles and kinetics of domain wall formation in ferroelectrics.

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