# X-ray fluorescence holography of $Nd_2CuO_4$

Kouichi HAYASHI[1*], Yukio TAKAHASHI[1], Ei-ichiro MATSUBARA[1], Takeharu MORI[2], Masahiko TANAKA[2], Hirotaka YAMAGUCHI[3]
[1]Tohoku Univ., 2-1-1 Katahira, Aoba-ku, Sendai 980-8577, Japan
[2]KEK-PF, Tsukuba, Ibaraki 305-0801, Japan
[3]AIST, Tsukuba, Ibaraki 305-8568, Japan

## Introduction

X-ray fluorescence holography (XFH) is a promising method for determination of a local environment around a particular element. One of most important applications of XFH is an observation of local lattice distortion of superconductor or colossal magnetic resistance materials induced by phase transition. In the present study, $Nd_2CuO_4$ was used as sample of XFH, and visualized local atomic images around Cu.

## Experimental

A dimension of $Nd_2CuO_4$ single crystal (001) was $5 \times 5 \times 2.0$ mm$^3$, was used as the measured sample. The incident energies were 17.0 - 19.5 keV with 0.5 keV steps. Cu Kα radiations emitted from the sample were analyzed and focused by the toroidally bent graphite analyzer. The focused fluorescence photons were detected by the APD. The intensities of Ge fluorescence was measured as a function of the azimuthal angle $\phi$ and polar angle $\theta$ within the range of $0° \le \phi \le 360°$ and $20° \le \theta \le 70°$.

## Results and Discussion

The collected data was processed by normalization with respect to incident intensities, removal of the large background, symmetrization using standing wave lines and low-pass filtering. Figure 1 shows a typical hologram pattern of $Nd_2CuO_4$ recorded at 18.0 keV. Atomic images were reconstructed from six holograms. Figures 2 (a), (b) and (c) show the planes parallel to the {001} lattice planes taken at distance of z = 0, 1.6 and 4.5 Å, respectively. Cu and Nd atoms were clearly visible. However, O atoms were not visible.

*khayashi@imr.tohoku.ac.jp

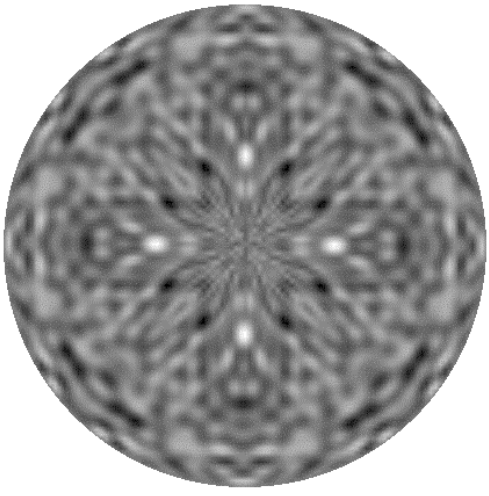

Fig. 1 X-ray hologram of $Nd_2CuO_4$. The incident energy was 18.0 keV.

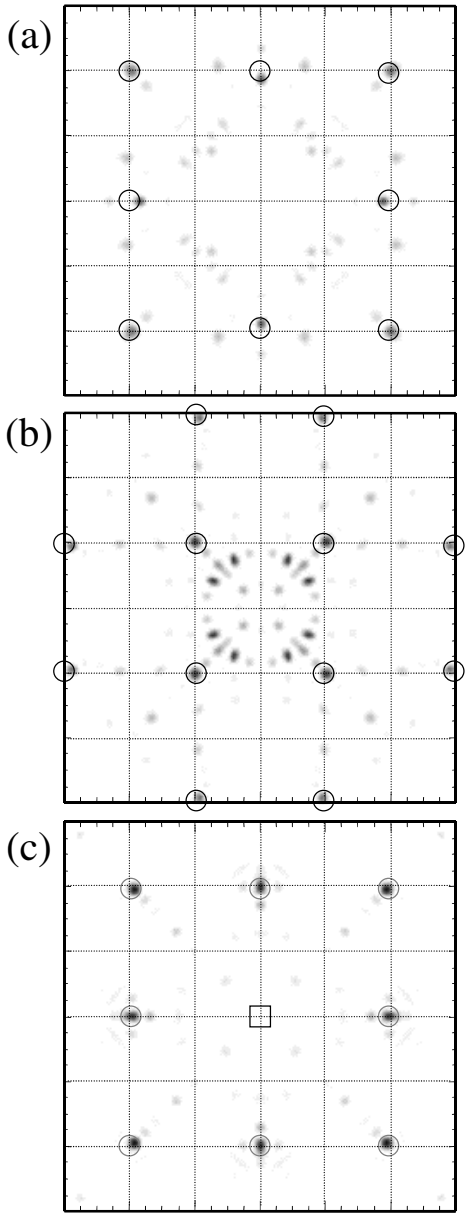


Fig. 2 Atomic images reconstructed from six holograms. Planes parallel to the {001} lattice planes taken at distance of z = (a) 0, (b) 1.6 and (c) 4.5.