PHASE CONTRAST TOMOGRAPHY RESEARCH USING COLD NEUTRON AT CHINA MIANYANG RESEARCH REACTOR

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Summary: The Institute of Nuclear Physics and Chemistry(INPC) of China Academy of Engineering Physics (CAEP) owns China Mianyang Research Reactor(CMRR) and builds cold/thermal neutron imaging facilities. Phase contrast tomography is one of the important aspect now and both simulation and experiment are carried out. Low attenuation contrast materials is tested with different conditions and the results show the validity of phase contrast.

1. INTRODUCTION

Neutron phase contrast imaging is a recently developmental technique which is based not only on the amplitude like in the projection imaging but also on the contribution of phase alteration of the neutron beam. With the additional contrast from the difference of neutron refraction index in the sample which mainly leads to edge enhancement, phase contrast imaging can show more details about the neutron phase materials, especially some low attenuation contrast materials. The Institute of Nuclear Physics and Chemistry(INPC) of China Academy of Engineering Physics (CAEP) owns China Mianyang Research Reactor(CMRR) and builds neutron imaging facilities based on cold and thermal neutrons. Different applications are carried on recently and phase contrast tomography is one of the important aspect.
Simulation based a homemade program is developed to confirm the flexibility of neutron phase contrast imaging at CMRR and the testing experiments are carried on to improve the simulation results. Low attenuation contrast materials like aluminium is test by phase contrast tomography with different conditions and the results show the validity of phase contrast.

2. EXPERIMENTALMETHOD

The experiments were performed at the cold beamline of the CMRR. The most probable neutron wavelength for this cold neutron imaging facility is 2.7Å. An 50μ m thickness ^{6}LiF/Zns-scintillator screen in conjunction with a Andor iKon CCD-camera(2048×2048 pixel) is used to record the neutron images. With a 85mm commercial lens, the field of view is 10cm×10cm. An Al sample is tested with different L/D. In order to obtain the phase contrast effect, the distance between sample and detector is 600mm. The tomography results are reconstructed by 180 projections and the exposure time for each projection are 20min(L/D=3600) and 20s(L/D=450) as show in Fig.1.

3. RESULTS

This work shows the recent development of phase contrast tomography in CMRR. The results show that a heterochromatic cold neutron source can be used to generate phase contrast image. The edge enhancement is observed in the reconstructed slice.

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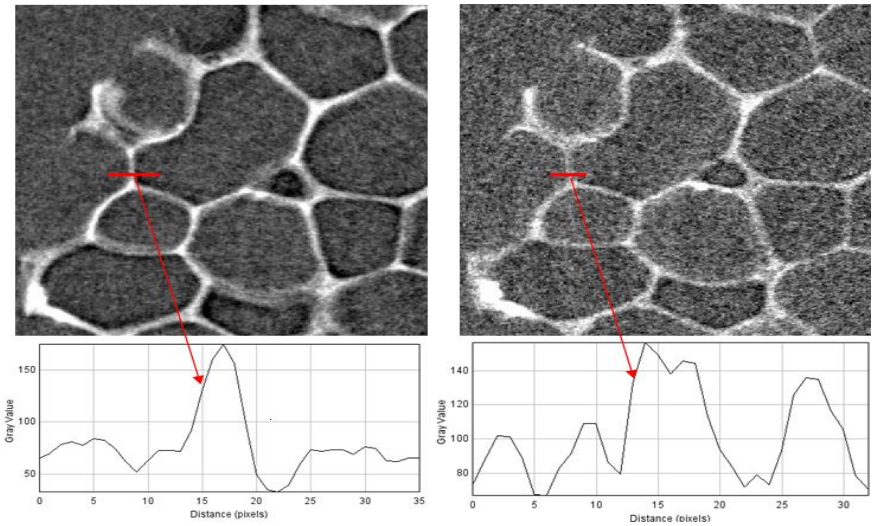
References

[1] Allman BE,et al. Phase radiography with neutrons, *Nature*, 408(6809) , 158-159, 2000.

[2] M.Strobl et al. On neutron phase contrast imaging, *Nucl. Instr. and Meth. in Phys. Res. B*, 266, 181-186,2008



(a) (b)

Figure 1: Phase contrast tomography results for a Al sample with different conditions (a) L/D 3600, the distance between sample and detector is 600mm. (b) L/D 450, the distance between sample and detector is 600mm.