

## Phase-Contrast X-Ray Imaging of Trace Forensic Samples Using Both Vertical and Horizontally Expanded Synchrotron Radiation X-Rays with Asymmetric Bragg Reflection

Toshio Ninomiya(4474)\*<sup>1</sup>, Seiji Muratsu(4675)<sup>1</sup>, Toyonaga Maeda(4676)<sup>1</sup>, Osamu Shimoda(4674)<sup>1</sup>, Junji Matsui(1232)<sup>2</sup>, Yasushi Kagoshima(1230)<sup>2</sup>, Yoshiyuki Tsusaka(1231)<sup>2</sup>, Kazushi Yokoyama(1341)<sup>3</sup>, Kengo Takai(3438)<sup>2</sup>, Takashi Ibuki(4208)<sup>2</sup>, Yoshiteru Marumo(4812)<sup>4</sup>, Shinichi Suzuki(4813)<sup>4</sup>, Yasuhiro Suzuki(4814)<sup>4</sup>, Masaaki Kasamatsu(4815)<sup>4</sup>

<sup>1</sup>Forensic Science Laboratory, Hyogo Pref. Police Headquarters,

<sup>2</sup>Faculty of Science, Himeji Institute of Technology,

<sup>3</sup>The New Industry Research Organization

<sup>4</sup>National Research Institute of Police Science

Though usual radiography is often used to observe contents of concealed samples with covering materials, this technique cannot afford to sharp contrast images of samples consisting of light elements. In this experiment, phase-contrast X-ray imaging has been successfully applied to observe inner structures of trace forensic samples consisting of light elements. The photon energy of the fundamental harmonic peak of the undulator was tuned to be 15 keV. Each exposure time is about one second. Results of the experiments are presented in Figs.1 to 4. Fig.1(right) shows the phase-contrast image of knitted fibers of a piece of panty hose and Fig.1(left) shows the optical microscopic picture of the same sample. Boundary structures of knitted fibers were observed in Fig.1(right) with excellent contrast in comparison with that shown in Fig.1(left). Phase-contrast images of 3 seeds of *Cannabis sativa L.*, leaves of which are well known to contain hallucinatory ingredients, have been shown in Fig.2 and also those of 3 seeds of *Datura stramonium L.*, in which toxic alkaloid ingredients are known to be contained, have been shown in Fig.3. As shown in Fig.2 and Fig.3, every seed has its own intrinsic inner structure although each resemble in shape and in external appearance. Fig.4 shows phase-contrast images of 6 kinds

of adhesive cloth-tapes, A~F. Each sample could be discriminated from one another by every phase-contrast image. As a conclusion, phase-contrast images of trace forensic samples can be applied as an useful nondestructive indicator to discriminate one from another.

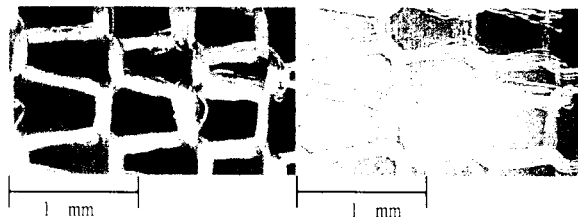


Fig.1(left) : Optical microscopic picture of knitted fibers of panty hose and Fig.1(right) : Phase-contrast image of the same sample.

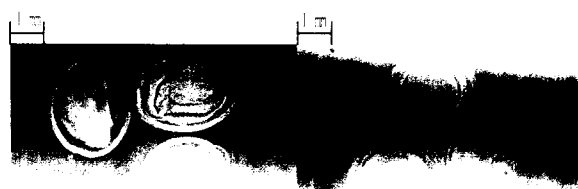


Fig.2

Fig.3

Fig.2. Phase-contrast images of *Cannabis sativa L.* seeds. Fig.3. Phase-contrast images of *Datura stramonium L.* seeds.

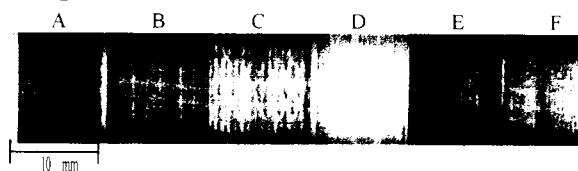


Fig.4. Phase-contrast images of adhesive cloth-tapes, A~F (from left to right).