Synchrotron Radiation Phase Contrast Imaging for Clear Visualization of Magnetic Particles

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Introduction

Magnetic particles are broadly used for separating different components of a sample. The visualization of magnetic particles is very essential for qualification and quantification of the components. However, conventional x-ray imaging techniques still have difficulties to clearly show magnetic particles especially when their x-ray attenuation is weak. Synchrotron radiation (SR) phase contrast imaging (PCI) has been widely utilized to improve soft tissue contrast[1-5]. In our study, SR absorption-based imaging (ABI) could not reveal the magnetic particles at all. In comparison, PCI could afford clear revelation of the beads (figure 1). The aggregation characteristics of magnetic particles under a magnet could also be evidently presented using PCI (figure 2). The results demonstrate that PCI has considerable potential for further detection studies by visibly displaying the magnetic particles.

Figure 1: SR images of magnetic particles. (b) and (d) are magnified images of the region in a red box in (a) and (c), respectively. The magnetic particles could be clearly seen on phase contrast image (d), but not on absorption contrast image (b).
Figure 2: PCI of magnetic particles under the influence of a magnetic field. Many magnetic particles were found to assemble along the upper edge of PE tube (arrows) by placing a permanent magnet over the tube.

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