

Traditional radiography uses geometric optics to explain image formation and relies on X-ray absorption differences for image contrast. Phase Contrast (PC) radiography uses wave optics to explain image formation and relies on phase shifts in the X-ray wave front for image contrast. PC effects have been explored primarily using monochromatic synchrotron radiation sources. Recently, our laboratory, along with others, has begun investigations of PC effects using a conventional polychromatic X-ray tube and a single-emulsion mammography film-screen cassette. In our experimental setup, we have utilized a small focal-spot (100 μm) X-ray tube to study the dependence of the PC effect on beam energy and radiation dose. At edges PC results in a characteristic overshoot/undershoot edge enhancement. PC effects are known to dominate in low-Z materials and are also known to fall off less rapidly with energy than photoelectric absorption, approximately $1/E^2$ versus $1/E^3$. These features make PC a promising candidate for improved soft-tissue mass detection. In phantoms (low-Z, Lucite stepwedges), we have studied PC edge-modulation as a function of tube kVp. Edge-modulation was defined as the ratio of the PC edge intensity difference relative to the absorption edge difference. In the range of 40-86 kVp, we found an entrance exposure reduction of 75%, while experiencing an edge-enhancement modulation reduction of only 12%. Spatial resolution of the system was demonstrated to be 20 lp/mm.