

## Phase-Contrast and Spectroscopic X-ray Imaging for Paperboard Quality Assurance

*Author licentiate thesis: Reza Salim*

*STC Research Center a part of Mid Sweden University*

### **Abstract:**

The end-use performance of a paperboard depends on its quality. The major properties of a good quality paperboard include consistency in the expected ratio between the thickness of the core and the coating layers, and the uniformity in the coating layer. Measurement systems using X-rays to monitor these properties could assist the paperboard industries to assure the quality of their products in a non-destructive and automatic manner.

Phase Contrast X-ray Imaging (PCXI) has been used successfully to look inside a wide range of objects using synchrotron radiation sources. Recent advancements in the grating interferometer based PCXI technique enables high quality phase-contrast and dark-eld images to be obtained using conventional X-ray tubes. The dark-eld images map the scattering inhomogeneities inside objects and is very sensitive to micro-structures, and thus, can reveal useful information about the object's inner structures, such as, the bre structures inside paperboards.

In this thesis, methods, using spectroscopic X-ray imaging and PCXI technique have been demonstrated to measure paperboard quality. The thicknesses of the core and the coating layers on a paperboard with the coating layer on only one side can be measured using spectroscopic X-ray imaging technique. However, the limited spectral and spatial resolution oered by the measurement system being used led to the measured thicknesses of the layers being lower than their actual thicknesses in the paperboard sample. Suggestions have been made in relation to overcoming these limitations and to enhance the performance of the method.

The dark-eld signals from paperboard samples with dierent quality indices are analysed. The isotropic and the anisotropic scattering coecients for all of the samples have been calculated. Based on the correlation between the isotropic coecients and the quality indices of the paperboards, suggestions have been made for paperboard quality measurements.