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The characterization of selected hand-made papers using X-ray scattering techniques

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This contribution will present the potential of X-ray Scattering techniques to characterize the nanostructure of selected hand-made papers. Hereby, the technique of Small Angle X-ray Scattering (SAXS) has been used for fibre orientation and degree of alignment characterization. Meaning an area of roughly 20 mm × 20 mm has been raster scanned with 0.2 mm resolution and the fibre orientation has been determined by the SAXS pattern analysis. Furthermore, Wide Angle X-ray Scattering (WAXS) has been simultaneously recorded that reveals the occurrence of crystalline phases. The techniques have been applied to a group of paper samples selected to account for possible regional differences in papermaking technologies, which include papers from Europe, Central Asia, Nepal, China and Japan. The samples selected for this part of the project are of known provenance and confirmed technological parameters.

The objectives of the X-ray scattering characterization of the hand-made papers are:

- Developing measurement protocols for paper samples using X-ray scattering and building up a database with the obtained structural parameters linked with known metadata such as origin, date, and manufacturing techniques.
- Based on the obtained results, designing methodology for the second stage as well as preparing and measuring samples manufactured with controlled parameters
- Analysis of aged paper structure using synchrotron radiation
- Understanding the potential damage to paper samples caused by synchrotron radiation

This part of the project consists in a preliminary report aimed at comparative analysis of the obtained X-ray results and the conventional laboratory characterization techniques such as optical and digital microscopy, or Fourier transform infrared spectroscopy.

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