

MS43 Crystallography for cultural heritage materials

MS43-01

Characterisation of heterogenous phases in wood from the Mary Rose: insight from computed tomography pair distribution function analysis

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Abstract

Salvaged in 1982 after spending 437 years under the sea bed, the Mary Rose hull has provided unprecedented insight into Tudor society and technology.¹ However, preserving this artefact for future generations remains a challenge. For example, the presence of sulfur, in combination with iron from corroded fixtures, is capable of forming destructive acids under atmospheric conditions,^{2,4} and development of effective conservation strategies requires detailed knowledge of the nature and distribution of these species in the wood. We have applied the recently developed computed tomography Pair Distribution Function analysis (ctPDF) to wood from the Mary Rose keelson.⁵ As well as occasional large salt particles, we find nanoparticles with diameters of less than 5 nm distributed through the wood at depths greater than 5 mm from the surface, most likely deposited by anaerobic bacteria. Surprisingly, nanocrystal structural analysis reveals these to be predominantly $Zn_{1-x}Fe_xS$. Polyethylene glycol, a polymer that has been introduced to stabilize the wood, is shown to penetrate only into the surface-region to 5 mm depth. This use of ctPDF to map and characterize crystalline but also amorphous and nanostructured phases in the wood results in crucial insights on the nature of compounds responsible for wood degradation, allowing the development of targeted conservation treatments.

References

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