Cultural Heritage analysis using Synchrotron Radiation: case studies in Ceramics, Glasses, and Lithologic Materials

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Synchrotron radiation is a powerful tool for non-destructive analysis of materials in cultural heritage research. It has revolutionized our ability to understand the composition, structure, and history of cultural heritage objects, leading to significant advances in fields such as archaeology, art conservation, and materials science. Dedicated beamlines for cultural heritage research are available at synchrotron facilities around the world, such as the European Synchrotron Radiation Facility (ESRF), SOLEIL synchrotron, and ALBA synchrotron, providing specialized support and instrumentation for high-resolution analysis of cultural heritage objects using various techniques, such as X-ray absorption spectroscopy, X-ray fluorescence, X-ray diffraction, and X-ray imaging.

The non-destructive approach provided by synchrotron radiation is essential for the preservation and restoration of cultural heritage objects, enabling researchers to gain valuable insights into their composition and structure without damage. Moreover, it can help researchers understand the production techniques and provenance of these objects, as well as their history of use. By analyzing objects at high spatial resolution, researchers can also obtain information on microstructural features, such as grain size, texture, and crystallographic orientation, that can be critical in understanding the material's properties and behavior.

In this communication, examples will be presented of the application of synchrotron radiation to the analysis of cultural heritage materials, focusing on ancient ceramics, glasses, archaeological slags, inorganic pigments, and lithologic materials. By gaining a deeper understanding of the composition, structure, and degradation processes of these materials, we can contribute to their long-term preservation and interpretation for future generations. Ultimately, the non-destructive

and high-resolution nature of synchrotron radiation provides a unique tool for investigating cultural heritage materials, advancing our knowledge of the past and providing insights for the future.

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