An OpenAIAr project: X-ray micro-tomography for the investigation of roman glass sherds from Aquileia (UD)

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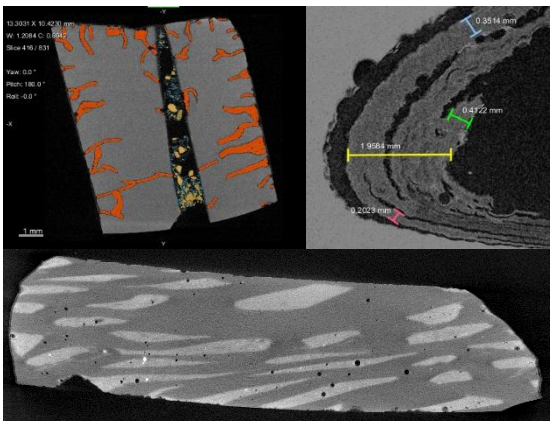
In the framework of the OpenAIAr project [1], investigation on some ancient Roman glass fragments through micro-tomographic analysis was conducted at the laboratory of the Physics Department of the University of Torino and INFN. X-ray Computed Tomography (CT) is a non-invasive technique already successfully applied to study and analyse the internal structures and features of different types of cultural artefacts, thus obtaining information on the composition, the manufacturing techniques, and the state of conservation [2,3]. The high heterogeneity of the constituent materials, the shapes and sizes of cultural heritage objects need specific experimental set-ups that have been developed and optimized over time. In this work, due to the dimension of the investigated samples and the high-resolution needed for the project aims, a micro-CT setup specifically designed and developed for the analysis of Cultural Heritage materials was employed [4]. The final aim was to explore, in a non-invasive manner, the 3D inner structure and material differences of ancient glass fragments coming from the archaeological site of Aquileia (UD). Both degraded and decorated glass samples were analysed, for a total of 12 samples; all of them were fully scanned by laboratory μCT. For some of the degraded samples affected by diffused 3D cracking, further analyses through synchrotron phase-contrast μCT were conducted. μCT scanning allowed to visualize the cracks of the degraded sherds in the reconstructed volume and to appreciate their internal structure and size. Several cracks totally filled with mineralized material, possibly coming from the soil in which the object was buried for centuries, extend into the bulk below the glass surface as visible. Furthermore, it was possible to observe the distribution of the material filling the fractures: soil grains were clearly distinguishable, as well as the areas into the cracks where air is present. About the decorated samples, some interesting information about the manufacturing and decoration techniques were obtained, as the use of different type of coloured glasses. Furthermore, additional radiopaque micrometric particles were found inside the glass bulk, which can be associated to precipitated colorant or opacifier used. The results obtained from this project confirm high-resolution μCT as a valuable technique to investigate archaeological glass objects in a completely non-invasive way, supporting restoration interventions and conservation treatments.

References

[1] https://www.associazioneaiar.com/wp/openaiar/
[2] M.P. Morigi et al., Application of X-ray Computed Tomography to Cultural Heritage diagnostics, Appl. Phys. A. 100 (2010) 653–661.
[3] L. Vigorelli et al., Comparison of two ancient Egyptian Middle Kingdom statuettes from the Museo Egizio of Torino through computed tomographic measurements, Journal of Archaeological Science: Reports 44 (2022) 103518
[4] F. Tansella et al., X-ray Computed Tomography Analysis of Historical Woodwind Instruments of the Late Eighteenth Century. J. Imaging 2022, 8, 260.



Tomographic slices of altered and decorated glasses