Spatial and Temporal Visualization of Polymorphic Transformations in Pharmaceutical Tablets

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In this talk, we present the application of X-ray Diffraction Computed Tomography (XRD-CT) to pharmaceutically relevant tablets subjected to varying compression pressures (Figure 1) — conditions known to influence intermolecular interactions and crystal packing. By incorporating the pressure-sensitive marker glycolide,[1,2] we were able to spatially resolve pressure-induced transformations within intact tablets, avoiding artifacts from sample preparation.[3] A follow-up study conducted one month later revealed an in-situ hydrolysis reaction of glycolide, highlighting the dynamic nature of the solid-state environment. The structure of the hydrolysis product was further elucidated using complementary electron diffraction techniques. These findings demonstrate the utility of XRD-CT for uncovering pressure- and time-dependent changes in molecular crystals, with implications for understanding non-covalent interaction networks and their role in the stability and evolution of pharmaceutical formulations.

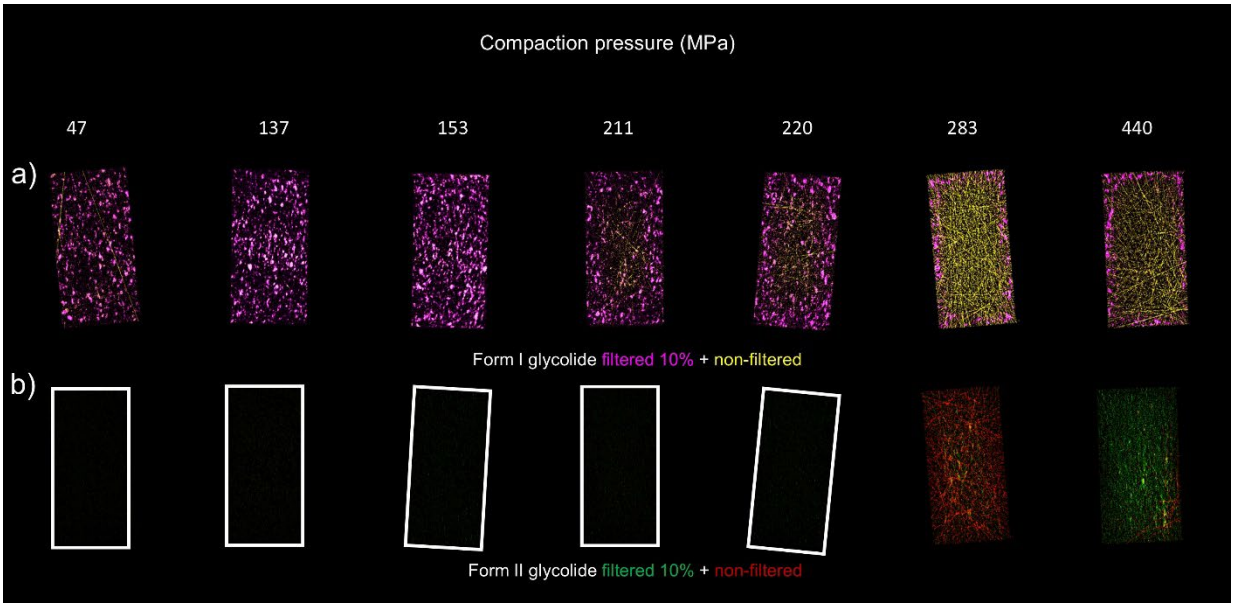

Figure 1. The XRD-CT images of tablets compressed to different compaction pressure indicating change in the polymorphism at higher compaction pressures.[3]

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[2] Hutchison, I. B.; Bull, C. L.; Marshall, W. G.; Parsons, S.; Urquhart, A. J.; Oswald, I. D. H. *Acta Crystallographica Section B: Structural Science, Crystal Engineering and Materials* **2017**, *73* (6), 1151–1157. https://doi.org/10.1107/S2052520617015657.

[3] Gasol-Cardona, J.; Ward, M. R.; Gutowski, O.; Drnec, J.; Jandl, C.; Stam, D.; Maloney, A. G. P.; Markl, D.; Price, S. W. T.; Oswald, I. D. H. *Angewandte Chemie International Edition* **2025**, *64* (2), e202412976. https://doi.org/10.1002/anie.202412976.