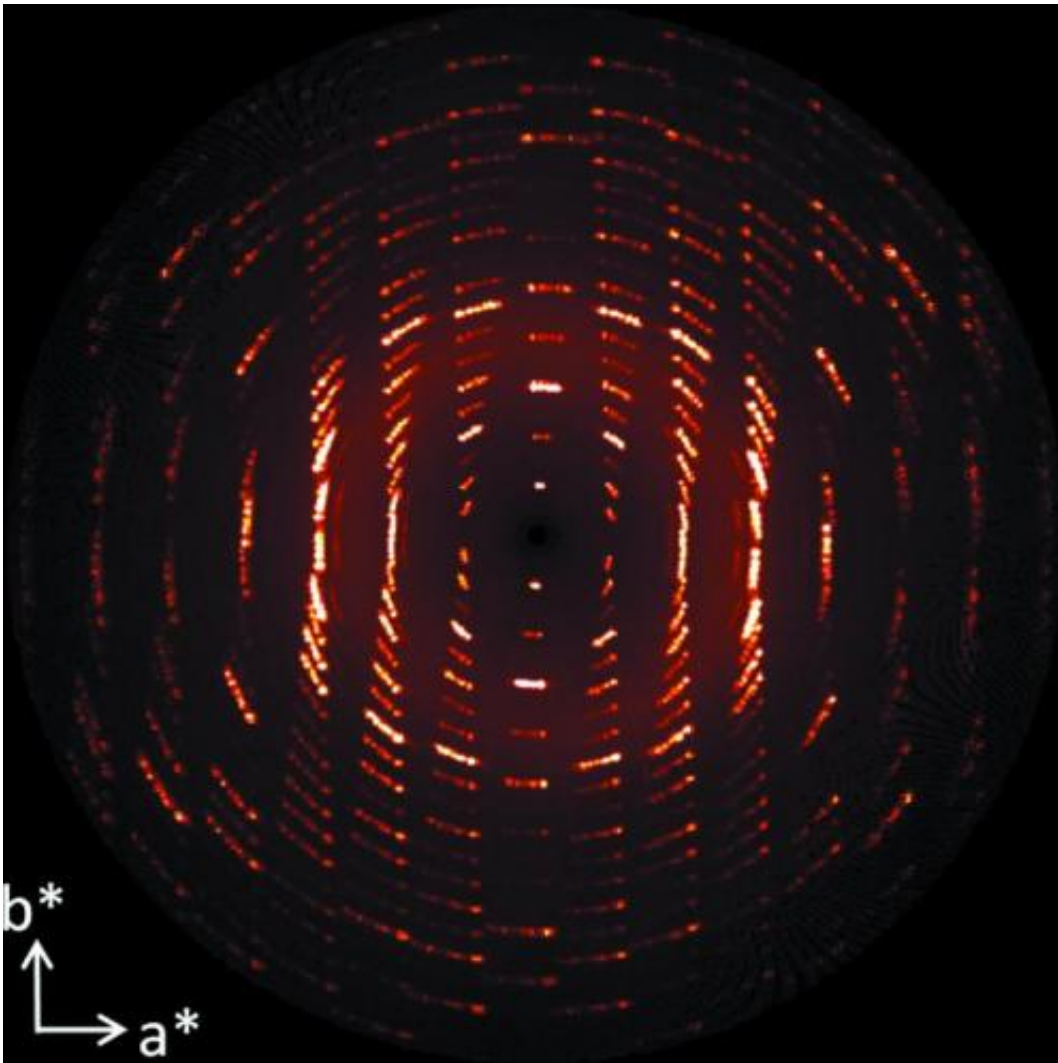


# Understanding active pharmaceutical ingredients

June 5 2014, by Jonathan Agbenyega

---



This image illustrates the observed reciprocal space reconstruction of  $hk0$  section showing rotational smearing after heating the crystal. Credit: Chan et al.

Active pharmaceutical ingredient (API), is the term used to refer to the biologically active component of a drug product (e.g. tablet, capsule). Drug products are usually composed of several components. The aforementioned API is the primary ingredient. Other ingredients are commonly known as "excipients" and these substances are always required to be biologically safe, often making up a variable fraction of the drug product. The procedure for optimizing and compositing this mixture of components used in the drug is known as "formulation". For example, if the API is a solid and the drug is required to have a liquid dosage form, such as a cough syrup, then the excipients would be the liquids that are used to formulate the syrup. The design criteria for any small molecule API is usually a combination of several factors that goes beyond the intended therapeutic effect, and usually heavily encompasses both pharmacokinetic and pharmacodynamic considerations, so for this reason, API molecules have many chemical functional groups.

The API form that is used in a formulation is often the most thermodynamically stable crystalline form. As such, the phenomenon of hydrogen bonding in combination with there being many [functional groups](#) on the API usually results in the available crystalline form being a hydrate.

Because of this fact the hydration behavior of crystalline APIs is of particularly high importance within the pharmaceutical industry, and is vastly studied from every possible angle. The state of hydration has a direct effect on the physical properties of the API, which in turn has a large impact on the [drug](#) processability and how the drug will eventually perform in-vivo, i.e. stability, solubility, and bioavailability.

Recently, a team of scientists in the department of Drug Product Science and Technology, at Bristol-Myers Squibb, USA have developed a supplementary technique to complement more conventional analysis (methods such as calorimetric studies, nuclear magnetic resonance and

vibrational spectroscopy) to study the behavior of hydration in organic crystalline solids.

By performing single crystal X-ray diffraction experiments with the ultimate objective being interpretation of the non-Bragg diffraction features, Chan et al, *Acta Cryst.* (2014). B70, 555-567 were able to gain further insight into the mechanical and structural details of the dehydration of the crystal. These scattering features were reproduced and studied using computer models and the results were able to show the mechanistic relationships between changes in the lattice structure as stages of the overall drying process.

This study is the first of its kind to combine the mechanism of dehydration and non-Bragg scattering features from a single API crystal and the results will further improve the knowledge, formulation and choice of API used in drug manufacture today. The group at BMS anticipates that these same data interpretation techniques will be useful to other researchers and that a more user friendly modeling software can be made available in the future.

**More information:** [dx.doi.org/10.1107/S2052520614005125](https://doi.org/10.1107/S2052520614005125)

Provided by International Union of Crystallography

Citation: Understanding active pharmaceutical ingredients (2014, June 5) retrieved 20 March 2024 from <https://phys.org/news/2014-06-pharmaceutical-ingredients.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.
---