Application of Simultaneous XRD-DSC Methods for the Physical Characterization of Solid Pharmaceuticals

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The pharmaceutical development challenges various processes from the exploration of potential candidates of API (active pharmaceutical ingredient) to the manufacturing of pharmaceutical products. To ensure the developability of drug candidates, the full understanding of physicochemical characteristics of API is indispensable for the formulation and manufacturing of pharmaceutical product.

In this presentation, the usefulness of simultaneous measurements of XRD-DSC will be introduced for the evaluation of various physicochemical characteristics of pharmaceuticals from API to pharmaceutical products.

APIs can exist in several crystalline states, such as polymorphs, hydrates and amorphous. Each compound may have different physical properties, such as dissolution properties, chemical stability and physical stability. So, the full understanding of diversity of crystalline form of targeting compound at early stage is essential for the successful development in the pharmaceutical industry. The optimal crystal form is chosen mainly based on the solubility and stability. The solid state phase transformation of pharmaceutical is also worrisome problem because the transformation may occur during the manufacturing process and the storage condition.

An adequate knowledge of structure properties is prerequisite for understanding mechanistic aspects of solid state transformation of each form. The thermodynamic understanding of each form is also essential for the elucidation of mutual polymorphs or pseudomorphous transformation. The simultaneous measurement of XRD-DSC and dynamic vapor sorption are powerful techniques for the evaluation of mutual solid state transformation of polymorphs and pseudomorphs on the bases of temperature and humidity. The crystal structure of each polymorphs and pseudomorphs are also analyzed based on single crystal X-ray structural analysis and powder X-ray structural analysis.

The mutual transformation mechanism of pharmaceuticals will introduce based on simultaneous measurement of XRD/DSC with the help of crystallography. As for pharmaceutical products, such as estimation of physical stability of solid dispersion, optimum manufacturing process of freeze drying product will be also introduced based on the research of simultaneous measurement of XRD-DSC.