Crystal morphology prediction of structures determined by X-ray powder diffraction

Fabio Furlan Ferreira[1] and Francesco Punzo[2]

[1]Federal University of ABC (UFABC), Santo André, SP, Brazil
[2]Università degli Studi di Catania, Catania, CT, Italy

The opportunity to predict crystal structures and crystal morphologies to optimize the drug production process is an approach that interests several pharmaceutical companies; in fact, before its use in the solid dosage forms, it is necessary to understand and characterize the physical and chemical properties of a drug, excipient, and their powder mixtures, including among other things crystal habit and particle size. On the other hand, the morphology of a pharmaceutical solid is of importance since this property can influence the bulk powder properties and may vary among different polymorphic forms of the drug thus affecting the pharmaceutical tableting as well.

The study of crystal structure prediction implies the analysis of the energetics related to the process, trying to evaluate the chances of the occurrence of a computationally predicted or experimentally evidenced polymorph. Our approach is based on the determination of the structures of the studied compounds by means of X-ray diffraction and the comparison of the tendency of the possible polymorphs to give rise to stable structures by performing a Molecular Dynamics (MD) simulation extended to the very fine details such as the atomic displacement parameters.

In this talk we are going to discuss some recent results on crystal structure determination of a series of synthetic parent compounds. The crystallographic information framework (cif) file generated from the structure determination procedure could also be used in a MD simulation to predict the crystal morphology, which is then compared to some optical and/or scanning electron microscopy images. The potential effect of the solvent on the crystal morphology is also discussed.