

DEHYDRATION INDUCED AMORPHIZATION OF TREHALOSE

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Trehalose is a disaccharide which plays a very important role in the preservation of biological molecules. The original glass behavior of the compound is expected to play a fundamental role in this interesting property. We have studied more specifically the dehydration induced amorphization of the compound which is effectively the original route followed in nature.

We present here calorimetric (DSC) and time resolved X ray diffraction investigations of the amorphization and vitrification of anhydrous trehalose by dehydration of its dihydrated form. The results reveal a rich pattern of non equilibrium phenomena which involves both stages of amorphization and formation of a metastable crystal form.

A fast dehydration is found to promote the amorphization stage, while a slow dehydration is found to promote the development of the metastable form which melts 10°C above the glass transition temperature. Moreover, the metastable form is characterized by broad Bragg peaks which indicate that this phase is nanostructured or ill crystallized.

Specific heat spectroscopy (MDSC measurements) have revealed that the amorphous state obtained by dehydration of trehalose dihydrate and by the usual thermal thermal quench of the liquid phase have very similar dynamical properties. They are characterized, in particular, by the same index of fragility.