

Technical Abstract No. 1:

How can one increase the data security and quality of CD-ROMs?

Problem: Glassy polymers such as polycarbonates are used in many demanding applications. One such example is the storage of data on compact disks. Currently, because of the intrinsic physical aging process, potential for water uptake or the presence of residual stresses, some size and shape relaxation gradually takes place on these disks. The result is distortions on the scale of a fraction of a percent per year. Such a distortion does not perceptibly impact the quality of musical compact disks. However, these distortions do have an impact on the accuracy of data storage, and a slight distortion can dramatically effect data accuracy. In light of these problems, manufacturers of compact discs typically only guarantee their quality for a few years.

Utilization of *Palmyra* to Improve Dimensional Stability: We will use a design goal of improving the dimensional stability of glassy polymers by a factor of five, and attempt to achieve this goal by placing small fractions of rigid high-aspect ratio platelets into the glassy polymers. We have found significant differences between numerical and Halpin-Tsai predictions on the dimensional stability.* For example, numerical results indicate that including about seven volume percent of platelets with an aspect ration of about 50 would suffice for the five-fold improvement in the dimensional stability. In contrast, the Halpin-Tsai equation suggests volume loads of about 20 % when dealing with platelets of the same aspect ratio.

Calculation with models such as the Halpin-Tsai consider only a few identical particles. However, in real composites the particles are of different size, shape and orientations, and may agglomerate. *Palmyra* can be used to carry out simulations considering all these effects, which allows to take the influence of shape and misalignment factors on the properties into account. *Palmyra* therefore allows to do customer-tuned calculations of a wide variety of composites and to accurately predict the required volume fraction of filler particles to give an optimal improvement of dimensional stability, thus saving time and money in performing expensive bench scale tests.

*) Ref: A. A. Gusev, *Macromolecules* 34(9), 3081 (2001).

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