Physics … With a Little Help From Chemistry

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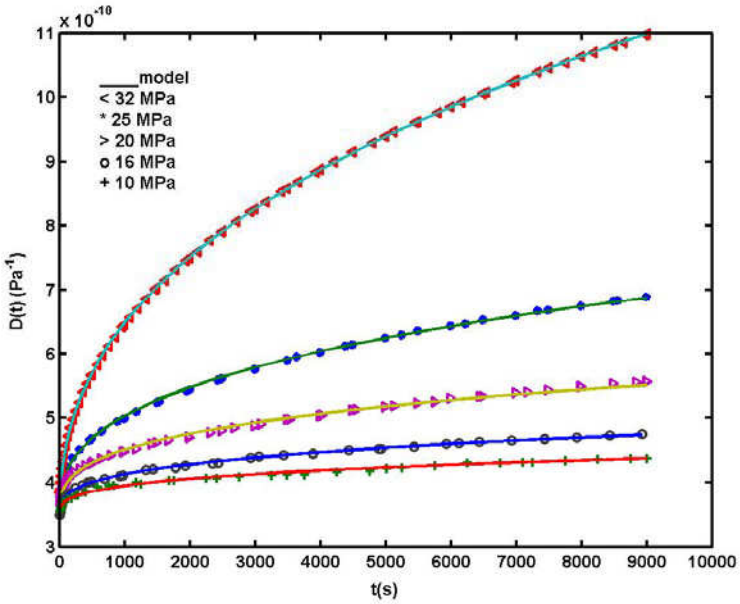
Physicists and chemists tend to cluster into somewhat separate "clubs", where they develop, train in and apply different concepts, methods, and even languages (not just vocabularies) to understand and describe how nature, materials, etc. behave, evolve and may be exploited. It is surprising, for example, how difficult (even unlikely) it is to find a physicist who knows what the *transition state theory* (TST) is and means, and how it may be fruitfully related to and used for so many aspects of materials physics, for polymers and non-polymers alike.

How it is, in fact, that what governs and explains the occurence, the rates and the industrial use of so many *chemical reactions* may at all determine how materials behave during an extremely wide range of *physical* (not chemical) *excitations* of practical relevance? Chemists and chemical engineers should in fact also try to learn and do some good physics, and physicists learn and use some good chemistry.



A sketch is presented of the application of TST to *materials tensile creep*, using an amorphous polymer, poly(methylmethacrylate), PMMA, as an example – cf. Figure, for creep at 40 ^{o}C. It is shown that it is possible to describe and quantitatively predict the gradual growth of strain, $\varepsilon(t,\sigma_0,T) = \sigma_0\, D(t,\sigma_0,T)$, under a constant applied stress, σ_0, D being the so-called *creep compliance*, where for most complex materials, the strain does not show a simple (though time-dependent) proportionality to stress, *i.e.* the compliance, D, is also stress-dependent (leading to non-linear behaviour), in addition to strongly temperature-dependent, particularly in the case of polymers. Physical significance and insight, more than mathematical detail, will be highlighted, as well as a range of other possible relevant applications.