argument applies in three dimensions in the case of simple cubic topology. Here the limiting functionality is $m_c = 6$.

The above named authors succeeded in elaborating a theory of rubber elasticity for rigid rod networks with $m < m_c$. The method applied is rather involved and will not be discussed here. The principal result of the calculation is shown in Figure 3.

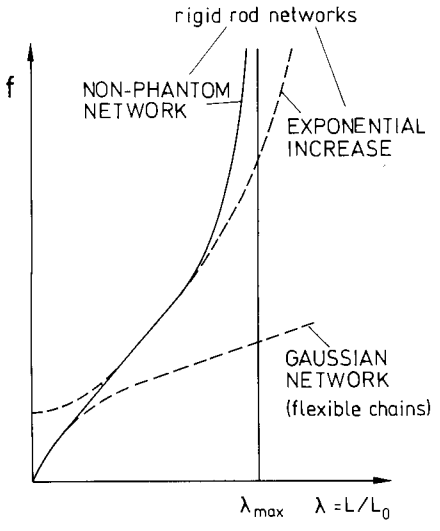

Fig. 3. Theoretical stress–strain relation of a rod network.

Here the stress per unit area f is plotted as a function of strain λ, where λ denotes the linear extension divided by the length at rest ($\lambda = L/L_0$). At low extensions the behavior resembles the results found for conventional networks.[1,2] At larger deformations the stress–strain relation crosses over to an exponential increase. Here obviously the rod-like nature of the chains within the network comes into play. It has to be noted that these results were derived for phantom networks, i.e., for systems without entanglement constraints. The authors also succeeded in including the latter effect into the model. Here theory predicts a maximum deformation at which the stress, as a function of strain, will diverge. This maximum deformation is a function of the concentration at the formation of the rod network. The physical argument leading to this divergence is again quite obvious: Due to the entanglement constraint the rods cannot move through each other but exert a mutual steric hindrance. With increasing extension of the network more and more rods will intersect and decrease the number of degrees of freedom of the system until the critical strain is reached.

This theory is the first attempt to tackle the problem of rigid rod networks. It is a mean-field approach and treats only isotropic systems. Such networks can be synthesized by simultaneous polymerization and cross-linking reaction. A totally different situation arises if cross-linking is effected in ordered liquid crystalline solutions or melts of rod-like polymers. Here the cross links would fix the liquid crystalline order even when the solvent is removed or the temperature is raised beyond the point of phase stability. This obviously provides numerous opportunities to design a whole class of new polymeric materials. The present work by *Vilgis, Boué* and *Edwards* thus could become an example for an interesting technical development preceded by theoretical ideas.

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