Opening remarks (Moderator's Comment)

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Opening remarks (Moderator's Comment)

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We are inclined to think that there are two approaches to the description of plasticity, that of the mécanismistes and that of the mécanicistes, the one which deals with atomic mechanisms and the one which is concerned only to describe the mechanical effects. We shall see this morning that this is not true. I do not think that either Professor Li or Professor Sidoroff will talk of atoms, yet they will use quite different languages.

The approach of the specialist in atomic mechanisms is perhaps the most fundamental. If the mechanisms are treated correctly, the resulting theory must be in accordance with the principles of thermodynamics. But, if we practitioners make approximations, we may reach results which diverge further from the requirements of thermodynamics the further we extend our results beyond the region in which our approximations are valid. Worse still, we tend to model only a limited set of atomic processes, which may predominate in one range, but may be relatively unimportant in another.

The experimental materials engineer is concerned to codify the results of observations. If his name is Li, he is well aware of the thermodynamic limitations laid down so clearly by E W Hart. His formulae will conform to the thermodynamical requirements within the experimental error; this does not always mean that their formal structure is thermodynamically permissible. Worse still, they are formulae of interpolation. Any extrapolation is based on analogy, at the best.

Finally, the specialist in continuum mechanics, such as Professor Sidoroff, begins by telling us what is thermodynamically possible. He is always right, but the choice of constitutive relations he offers us is too wide to be useful. He may be inclined to select relations because of their mathematical convenience, and often, as Einstein liked to point out, these accord with reality. Otherwise he is less well equipped than the specialist in atomic mechanisms to decide which relations are appropriate to particular sets of parameters. Relevant or not, his results are always self-consistent.

We must not attempt to put these three approaches in an order of merit. What this conference is bringing home to us is that, regardless of our personal preferences of approach, a full understanding must take account of atomic mechanisms, of empirical observations, and of the range and limitations of the theoretical possibilities.