DESIGN METHODS FOR STRUCTURES OPERATING AT HIGH TEMPERATURE

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The past five years has seen the development of analysis techniques to establish stress and strain levels in structures of complex shape operating in the creep range. At the one extreme, there are relatively expensive and time consuming methods using finite elements which require a detailed knowledge of materials behavior, and yield precise information on the stress and strain history in the structure. At the other extreme, are approximate methods using the simplest materials data which, nevertheless, often yield information which is sufficiently accurate for engineering application.

What is often overlooked is that the calculated results for stresses and strains do not, in themselves, provide a design method. The stress and strain conditions at critical points in the structure must be combined with failure data on the materials of construction, to provide an estimate of the useful working life of the component.

The paper describes the more important calculation methods which are available to the designer and discusses the accuracy which may be expected. It then goes on to describe ways in which the useful working life of the structure may be predicted from materials data obtained in conventional tests. Experimental work which is currently being undertaken to confirm the reliability of these design methods is also described.

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DISCUSSION

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Could you suggest a method for evaluating the life of high temperature structures exposed to design loads in order to ascertain whether they should be continued in service when specimens of the structure cannot be tested ?

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I will suggest that this is done by evaluating stress loads, and comparing the stress loads with internals data. In extreme cases, it would be necessary to provide internal test specimens which monitor the behaviour of the internals.