

# Fracture and Fatigue: Some New Insights

## FOREWORD

It is over nine decades since fracture mechanics found its importance in the design of mechanical, aerospace and civil engineering structures. Its application started in naval structures during the early part of 20th century.

The theory of fracture mechanics was initially found ideal to explain the failure of brittle materials like glass. Later it was modified for metals and now for quasi-brittle materials like concrete. It was further extended to polymers and much softer materials in the recent past. An important offshoot of fracture mechanics is the size effect which is clearly and strongly observed in quasi-brittle and heterogeneous materials like concrete.

In concrete, it is well-established that strength reduces with size. Other related factors are the presence of a fracture process zone (FPZ) and softening. Further, a study on FPZ has shown that the entire fracture behaviour is governed by fracture process at different like micro-, meso- and macro scales. This led to multi-scale modelling of fracture. Size effect is also observed in other materials like magnesium.

By now, it is clear that fracture at different scales is governed by different principles of physics. Materials like thin films, single crystals and metallic glasses are quite at variance with large-sized quasi-brittle materials like concrete in terms of their fracture behaviour.

Fracture caused by fatigue has a very different character and needs a special study. With the above in view, it was felt that a collection of papers devoted exclusively to bring out the above aspects would be useful for further research. This special issue of SADHANA presents papers dealing with the above topics.

I sincerely thank all the authors for presenting their current ideas. My personal thanks are due to Professor R N Iyengar, the former editor of the Journal, who inspired and encouraged me to be the guest editor of this volume. My sincere thanks are due to the editor, Professor S M Deshpande, Mr T D Mahabaleswara, Mr G Madhavan and Ms N Padmaja for their help in bringing out this special issue.

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