

On the design of polymeric composite structures for cold regions applications

Lord, H. W. and Dutta, P. K. *Journal of Reinforced Plastics and Composites* Vol 7 (September 1988) pp 435-458

The paper focuses attention on low temperature hygrothermal effects which influence short and long term behaviour of polymer composite materials for cold region applications. The authors review the available literature on low temperature related problems revealing the scarcity of low-temperature performance data. Problem areas are identified along with areas where more research is needed to develop a suitable data base required for design of composite materials for cold environments.

Structural design optimisation of composite laminates

Ishai, O., Krishnamachari, S. and Broutman, L. J. *Journal of Reinforced Plastics and Composites* Vol 7 (September 1988) pp 459-474

A method is presented by which both material selection and strength beyond first ply failure are included in the optimization scheme. The method utilizes non-dimensional parameters as indicators of the laminate structural performance.

Field repair of composite structures

English, L. K. *Materials Engineering* (September 1988) pp 37-39

This article describes relatively easy to use repair systems and procedures which do not require substantial equipment for the repair of composite structures making field maintenance a cost-effective reality.

Fabricating the future with composite materials: a primer

English, L. K. *Materials Engineering* (September 1988) pp 53-57

This is an article defining composites terminology and explaining the basic concepts and processes involved in the fabrication of composite materials.

Composites reference library

Materials Engineering (September 1988) pp 71

This article provides an index of coverage of composite materials testing and fabrication appearing in *Materials Engineering* since January, 1986.

Crack nucleation at the surface of stressed fibers

Bouten, P. C. P. and With, G. de *Journal of Applied Physics* Vol 64 No 8 (15 October 1988) pp 3890-3900

A new model is presented for the failure of a perfect fibre. The model contains both a stability criterion (comparable to the Griffith criterion) and a kinetic description (comparable to conventional stress assisted corrosion behaviour). Using this model, expressions for the lifetime under applied stresses are calculated for cases with and without initial cracks.

Setting stress distribution in particle reinforced polymer composites

Boriek, A. M., Akin, J. E. and Armeniades, C. D. *Journal of Composite Materials* Vol 22 (October 1988) pp 986-1002

Three dimensional finite element analysis was used to investigate the setting stresses

due to resin shrinkage during cure in a highly filled polymer composite such as polymer concrete. The effect of geometrical arrangement of spherical aggregates in cubic, face-centred cubic arrangement and hexagonal close packing arrangements of prism shaped aggregates were considered. It was found that the hexagonal, prism shaped aggregate particles introduced higher tensile stresses than the spherical particles. A higher packing factor resulted in a lower magnitude of stresses throughout the system.

Influence of finite width on notched laminate strength predictions

Gillespie, Jr, J. W. and Carlsson, L. A. *Composites Science and Technology* Vol 32 No 1 (1988) pp 15-30

A stress fracture criterion that quantifies notched strength for finite width geometries is presented and limitations of tradition methodology discussed. A finite element analysis is presented for isotropic and orthotropic plates containing circular notches and used in comparison with results obtained from B/A1 composites and in various graphite/epoxy laminates. It is shown that for plates containing holes with a width-to-diameter ratio < 4 a substantial change in the normal stress distribution occurs and therefore experimental programmes should be designed with the geometric constraint, $w/d \geq 4$.

Modern Boron and SiC CVD filaments: a comparative study

Le Petitcorps, Y., Lahaye, M., Pailler, R. and Naslain, R. *Composites Science and Technology* Vol 32 No 1 (1988) pp 31-55

The mechanical properties and chemical compositions of several types of large diameter (100-150 μm) silicon carbide filaments were studied in detail. Emphasis was placed upon their chemical composition, failure strength, and strength retention after annealing at high temperature in vacuum or in the presence of titanium. The filaments, formed by chemical vapour deposition onto a carbon or tungsten core, have been compared with large-diameter boron filaments, prepared in a similar manner. Coating of the filaments is also discussed in detail and shown to enhance their performance. They are presented as candidate materials for reinforcing metal matrices.

Evaluation of the IITRI compression test method for stiffness and strength determination

Bogetti, T. A., Gillespie, Jr, J. W. and Pipes, R. B. *Composites Science and Technology* Vol 32 No 1 (1988) pp 57-76

The IITRI compression test method for measuring the axial compressive modulus and strength of composite materials possessing a high degree of anisotropy in the axial direction is critically examined. The finite element method and Sinat-Venant's principle are used in this examination. Recommendations such as sizing specimen geometry for carrying out the test are made. It is shown that, based on the degree of material anisotropy and failure strain, the appropriateness of the test method for a given material system can be evaluated.

Effect of porosity on interfacial failure in steel-fibre-reinforced polymer-impregnated concrete

Gündüz, G. *Composites Science and Technology* Vol 32 No 2 (1988) pp 121-136

Pull-out tests carried out on a steel wire embedded in a concrete cylinder were used to determine the interfacial strength of steel fibres in concrete. Various concrete mixes were prepared: containing no sand, containing varying amounts of naphthalene, and varying amounts of a styrene-acrylonitrile polymer, injected by pressure or vacuum impregnation. It was found that the addition of up to 3 wt % naphthalene and drying the concrete at 150°C improved polymer impregnation, and increased polymer loading, without changing the porosity of the concrete, improved the interfacial bond strength. Vacuum impregnation gave the best results.

Finite element analysis of laminated composite plates using a higher-order displacement model

Pandya, B. N. and Kant, T. *Composites Science and Technology* Vol 32 No 2 (1988) pp 137-155

A C^∞ continuous displacement finite element formulation of a higher-order theory for flexure of thick, arbitrary laminated composite plates under transverse loading is presented. The model accounts for non-linear and constant variation of in-plane and transverse displacement through the plate thickness and eliminates the use of shear correction coefficients. Results for plate deformations, internal stress-resultants and stresses for selected examples are shown to agree well with other models developed by the authors. A computer program which incorporates the prediction of interlaminar stresses from equilibrium equations has been developed.

METAL MATRICES

Static and fatigue notch strength prediction in alumina fiber reinforced aluminium plates with a circular hole

Tsangarakism N., Slepetz, J. M. and Nunes, J. *Journal of Composite Materials* Vol 22 (April 1988) pp 386-393

The Whitney and Nuismer model was applied to predict the static strength and endurance limit of unidirectional FP/Al plates with circular holes. The effect of the minimum to maximum fatigue stress ratio R on the endurance limit of unnotched FP/Al specimens was also investigated. It was found that the calculated values agreed well with experimentally determined data for strength while the endurance limit was underestimated with wide specimens and large diameter holes. The endurance limit of unnotched specimens was found to depend on R .

Erosion of fiber-reinforced Al-4 pct Cu composites

Srinivassan, S., Scattergood, R. O. and Warren, R. *Metallurgical transactions A* Vol 19A (July 1988) pp 1785-1793

The erosion behaviour of a series of alumina fibre reinforced Al-4 pct-Cu metal matrix composites containing up to 30 volume per cent alumina fibres is reported. The erosion rates were found to increase significantly with increasing fibre content. Low angle