OP-2-267

Wednsday, May 11, 2011, 11:30-11:50 am
Room: Reda 5

EFFECT OF LOAD HISTORY ON THE FIBRE PARALLEL COMPRESSION STRENGTH IN FIBRE REINFORCED

W. Michaeli, Ch. Hopmann, L. Lambrecht*, K. Fischer

Institute of Plastics Processing at RWTH Aachen University (IKV),Pontstr. 49, 52062 Aachen, Germany

Corresponding author: Lambrecht@ikv.rwth-aachen.de

For the reliable design of statically or dynamically loaded lightweight structures made of fibre reinforced plastics (FRP), a wide knowledge of the material-specific failure behaviour is necessary. Depending on their loading conditions laminates made of FRP fail by one of the macroscopic failure modes named fibre fracture, inter-fibre fracture or delamination. When structures made of FRPs are designed to be used in load bearing applications the evaluation of their load carrying capacity in compression parallel to fibre direction is of primary interest. For this purpose, a vast number of research investigations, whose main objective is linked to determining the compression strength of a structure out of FRPs, has been carried out. Influencing factors, which have been considered, are fibre properties, fibre volume content, non-linear matrix properties, interface properties, residual stresses, fibre misalignment and ply waviness.
An additional influence factor which has not yet been discussed in literature is the influence of the load history. Shear loading and loading transverse to fibre direction lead to microscopic damages – so called micro-cracks – which accumulate in fibre-reinforced plastics at increasing static load or cyclic loading conditions long before the first macroscopic damage occurs. Furthermore, they influence the compression strength parallel to fibre direction.
In this paper, the appearance of micro-cracks in carbon fibre reinforced plastics (CFRP) and their influence on the strength of CFRP will be discussed. Experimental investigations have been performed with different loading conditions to create defined damage states. Afterwards, the residual fibre parallel compression strength has been investigated. The results show that an increasing amount of micro-cracks leads to a decrease of the compression strength.