An InGaP heterojunction barrier solar cell consists of a single, ultra-wide GaAs, aluminum-gallium-arsenide (AlGaAs), or lower-energy-gap InGaP absorber well placed within the depletion region of an otherwise wide bandgap PIN diode. Photogenerated electron collection is unencumbered in this structure. InGaAs wells can be added to the thick GaAs absorber layer to capture lower-energy photons.

This work was done by Roger E. Welser of Kopin Corporation for Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18393-1

Straight-Pore Microfilter With Efficient Regeneration

John H. Glenn Research Center, Cleveland, Ohio

A novel, high-efficiency gas particulate filter has precise particle size screening, low pressure drop, and a simple and fast regeneration process. The regeneration process, which requires minimal material and energy consumption, can be completely automated, and the filtration performance can be restored within a very short period of time.

This filter media may not be the complete replacement for other filtration technologies, but can be a key component in a complete system. This design removes the majority of airborne particulates, with its fast regeneration time allowing a significant increase in the operating period of other filtration media (if necessary) between replacement/regeneration.

Conventional filter media are based on polymer/glass fibers, but this filter is of a novel material composite that contains the support structure and a novel coating. The support structure gives the filter good mechanical properties, while the novel coating creates a unique regeneration character. Also, this support structure can be prepared by laser micromachining etching (i.e. a chemical laser), or micro-molding technology. A novel coating shell is then formed on the support structure to further reduce the pore diameter.

This work was done by Han Liu, Anthony B. LaConti, Thomas J. McCallum, and Edwin W. Schmitt of Giner Electrochemical Systems, LLC for Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18498-1.

Determining Shear Stress Distribution in a Laminate

The simplified shear solution does not require solution of a particular boundary value problem.

John H. Glenn Research Center, Cleveland, Ohio

A "simplified shear solution" method approximates the through-thickness shear stress distribution within a composite laminate based on an extension of laminated beam theory. The method does not consider the solution of a particular boundary value problem; rather, it requires only knowledge of the global shear loading, geometry, and material properties of the laminate or panel. It is thus analogous to lamination theory in that ply-level stresses can be efficiently determined from global load resultants at a given location in a structure and used to evaluate the margin of safety on a ply-by-ply basis. The simplified shear solution stress distribution is zero at free surfaces, continuous at ply boundaries, and integrates to the applied shear load. The method has been incorporated within the HyperSizer® commercial structural sizing software to improve its predictive capability for designing composite structures.

The HyperSizer structural sizing software is used extensively by NASA to design composite structures. In the case of through-thickness shear loading on panels, HyperSizer previously included a basic, industry-standard, method for approximating the resulting shear stress distribution in sandwich panels. However, no such method was employed for solid laminate panels.

The purpose of the innovation is to provide an approximation of the through-thickness shear stresses in a solid laminate given the through-thickness shear loads (Q_x and Q_y) on the panel. The method was needed for implementation within the HyperSizer structural sizing software so that the approximated ply-level shear stresses could be utilized in a failure theory to assess the adequacy of a panel design.

The simplified shear solution method was developed based on extending and generalizing bi-material beam theory to platelike structures. It is assumed that the through-thickness shear stresses arise due to local bending of the laminate induced by the through-thickness shear load, and by imposing equilibrium both vertically and horizontally, the through-thickness shear stress distribution can be calculated. The resulting shear stresses integrate to the applied shear load, are continuous at the ply interfaces, and are zero at the laminate-free surfaces. If both Q_x and Q_y shear loads are present, it is assumed that they act independently and that their effects can be superposed. The calculated shear stresses can be rotated within each ply to the principal material coordinates for use in a ply-level failure criterion.

The novelty of the simplified shear solution method is its simplicity and the fact that it does not require solution of a particular boundary value problem. The advantages of the innovation are that an approximation of the though-thickness shear stress distribution can be quickly determined for any solid laminate or solid laminate region within a stiffened panel.

This work was done by Brett A. Bednarcyk and Jacob Aboudi of Ohio Aerospace Institute and Phillip W. Yarrington of the Collier Research Corp. for Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18441-1.