Experimental determination of the micro-scale strength and stress-strain relation of an epoxy resin - DTU Orbit (08/11/2017)

Experimental determination of the micro-scale strength and stress-strain relation of an epoxy resin

An approach is developed for determining the stress-strain law and a failure stress appropriate for micro-mechanical models of polymer materials. Double cantilever beam test specimens, made of an epoxy polymer with notches having finite root radius, were subjected to pure bending moments in an environmental scanning electron microscope. The recorded images were used to measure strains around the notch with a 2D digital image correlation method. The strain in front of the notch was found to reach 20% before the failure initiation, which significantly exceeds the failure strain measured at the macro-scale (5–6%). The hardening exponent of a power law hardening material was obtained by the use of the J-integral, estimating the strain energy density around the notch. The hardening exponent was found to be within the range of 5–6 and the corresponding micro-scale failure stress was in the range of 220–300 MPa. Furthermore, the experimentally measured strains around the notch edge were compared with the strain field of the HRR-field. In addition, our experimental study shows that the strain fields between the notches with different notch root radii are comparable, if all length parameters are normalized with the width of deformed notch.

General information

State: Published
Organisations: Department of Wind Energy, Composites and Materials Mechanics
Authors: Zike, S. (Intern), Sørensen, B. F. (Intern), Mikkelsen, L. P. (Intern)
Pages: 47-60
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

Journal: Materials & Design
Volume: 98
ISSN (Print): 0264-1275
Ratings:

BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.9 SJR 1.751 SNIP 2.481
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.885 SNIP 2.654 CiteScore 4.51
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.418 SNIP 3.474 CiteScore 4.36
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.045 SNIP 3.269 CiteScore 3.8
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.988 SNIP 3.212 CiteScore 3.31
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.406 SNIP 2.521 CiteScore 2.63
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.07 SNIP 1.822
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.93 SNIP 1.81
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.973 SNIP 1.361
Scopus rating (2007): SJR 0.846 SNIP 1.68

Scopus rating (2006): SJR 0.666 SNIP 1.415
Scopus rating (2005): SJR 0.739 SNIP 1.373
Scopus rating (2004): SJR 0.52 SNIP 1.167
Scopus rating (2003): SJR 0.565 SNIP 1.201
Scopus rating (2002): SJR 0.574 SNIP 1.165
Scopus rating (2001): SJR 0.374 SNIP 0.59
Scopus rating (2000): SJR 0.242 SNIP 0.716
Scopus rating (1999): SJR 0.192 SNIP 0.339
Original language: English
Micro-scale test, Micro-mechanical models, In-situ testing, Polymer/fibre composites, Epoxy matrix
DOIs:
10.1016/j.matdes.2016.02.102
Publication: Research - peer-review › Journal article – Annual report year: 2016