LADICIM
LABORATORIO DE LA DIVISIÓN DE CIENCIA E INGENIERÍA DE LOS MATERIALES

NOTCH FRACTURE IN COMPOSITES

Francisco Tomás Ibáñez Gutiérrez

1. First year evaluation

1. Competencies developed through the PhD. Experience

I. A systematic comprehension of a **particular field** of study as well as a thorough knowledge of its related skills and methods: **Fracture mechanics on composite materials**

II. Ability to conceive, design or model, put in practice or choose a particular **process of researching**: **Different experimental programmes developed and analysed**

III. Ability to contribute to the development at the **frontiers of the knowledge** addressing an original research: **PhD dissertation, publications…**

IV. Ability to synthetize, analyze or assess critically new complex ideas: **Daily work**

V. Ability to **communicate and explain advanced ideas** or knowledge for the academic community or for Society: **Publications, participation in conferences (national and international)…**

VI. Ability to promote scientific, technological, social, artistic or cultural progress in a based knowledge Society, either in academic or professional environments **PhD dissertation, publications, conferences and ORGANIZATION AND MANAGEMENT OF TWO CONFERENCES (INT & NAT)**

To work within contexts with little specific information; to find the key questions in order to solve complex problems; to design, create, develop and undertake new and innovative projects in a particular field of knowledge; Teamwork and international context; to either criticize or support intellectual proposals…

1. First year evaluation

2. Evaluation:

- ✓ Assessment of the activity and performance of the PhD. student:

  DAD (Document of Activities of the student)

- ✓ Assessment and endorsement of competencies:

  PR (Plan of research)

Academic Committee of the doctoral program

2. Research status/contributions

1

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Review article

Effect of fibre content and notch radius in the fracture behaviour of short glass fibre reinforced polyamide 6: An approach from the Theory of Critical Distances

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Journal Metrics

CiteScore: 4.29

More about CiteScore

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SCImago Journal Rank (SJR): 2.125

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B. Stress concentrations
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Notch

ABSTRACT

This paper presents an analysis of the notch effect on the fracture behaviour of short glass fibre reinforced polyamide 6 (SGFR-PA6) with different amounts of fibre content. The research is based on the results obtained in an experimental programme composed of 125 fracture specimens, combining five different fibre contents and five different notch radii. Concerning the apparent fracture toughness, a clear notch effect has been observed, with an increase in the fracture resistance when the notch radius increases. Moreover, the apparent fracture toughness has been reasonably predicted through the Theory of Critical Distances. The results have also shown a direct relation between the apparent fracture toughness and the fibre content. The research is completed with the Scanning Electron Microscopy analysis of the evolution of the fracture micromechanisms when both the notch radius and the fibre contents increase.

2. Research status/contributions

2

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Fracture assessment of notched short glass fibre reinforced polyamide 6: An approach from failure assessment diagrams and the theory of critical distances

F.T. Ibáñez-Gutiérrez*, S. Cicero

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Keywords:
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Mechanical testing
Notch

ABSTRACT

This paper provides a structural integrity assessment methodology for the analysis of notched short glass fibre reinforced polyamide 6 (SGFR-PA6). The proposal combines the use of Failure Assessment Diagrams for the fracture assessment and the application of the Theory of Critical Distances for the estimation of the apparent fracture toughness. The assumption that notches behave as cracks may be over conservative, so that the proposal here is to convert the notched situation into an equivalent cracked situation in which the material develops a higher fracture resistance. The methodology has been applied to 125 fracture specimens, combining five different fibre contents and five different notch radii. The results obtained validate the proposed assessment methodology, with a clear reduction of the conservatism obtained when the notch effect is not considered.

2. Research status/contributions

3

Soon

FRACTURE LOADS PREDICTION ON NOTCHED SHORT GLASS FIBRE REINFORCED POLYAMIDE 6 USING THE STRAIN ENERGY DENSITY

F.T. Ibáñez-Gutiérrez[1]*, S. Cicero[1], V. Madrazo[2], F. Berto[3]

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[2]Centro Tecnológico de Componentes-CTC, C/ Isabel Torres 1, 39011, Santander, Cantabria, Spain
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ABSTRACT

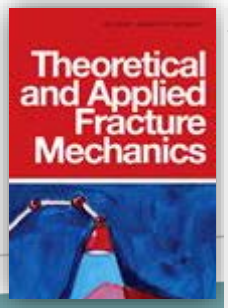
This paper provides an energetic approach useful for the prediction of critical loads on U-notched components without an ideally linear elastic behaviour. The methodology has been applied to 100 fracture specimens of short glass fibre reinforced polyamide 6 (SGFR-PA6), combining four different fibre contents (5 wt.%, 10 wt.%, 30 wt.% and 50 wt.%) and five different notch radii (0 mm, 0.25 mm, 0.5 mm, 1.0 mm and 2.0 mm). The proposal combines the application of the Strain Energy Density (SED) criterion with the use of the whole absorbed energy in the tensile test (elastic-plastic area under the stress-strain curve). With all of this, the fracture loads have been well estimated in this type of material.

Keywords: Short glass fibre reinforced Polyamide 6, Strain Energy Density, Notch, Fracture assessment

2. Research status/contributions

- 33th Meeting of the Spanish Society of Structural Integrity (San Sebastián, 03.2016)
  - **ANÁLISIS DEL EFECTO ENTALLA EN POLIAMIDA 6 REFORZADA CON FIBRA DE VIDRIO CORTA**
- 17th European Conference on Composite Materials (Munich-Germany, 06.2016)
  - **ANALYSIS OF NOTCH EFFECT IN SHORT GLASS FIBRE REINFORCED POLYAMIDE 6**
- 34th Meeting of the Spanish Society of Structural Integrity (Santander, 03.2017)
  - **PROPUESTA DE CURVA S-N DE DISEÑO PARA ACEROS ESTRUCTURALES CON BORDES RECTOS CORTADOS POR PLASMA**
  - **PROPUESTA DE CURVA S-N DE DISEÑO PARA CHAPAS DE ACERO ESTRUCTURAL CON AGUJEROS CORTADOS POR LÁSER**
- International Symposium on Notch Fracture (Santander, 03.2017)
  - **SED CRITERION ESTIMATIONS OF FRACTURE LOADS IN STRUCTURAL STEELS OPERATING AT LOWER SHELF TEMPERATURES AND CONTAINING U-NOTCHES**

Special issue



Journal Metrics

CiteScore: 2.05

More about CiteScore

Impact Factor: 2.025

5-Year Impact Factor: 1.719

Source Normalized Impact per Paper (SNIP): 1.433

SCImago Journal Rank (SJR): 0.835

2. Research status/contributions

- 14th International Conference on Fracture (Rhodes-Greece, 06.2017)

➢ ***PROPOSAL OF A STRAIGHTFORWARD STRUCTURAL INTEGRITY ASSESSMENT METHODOLOGY OF COMPONENTS CONTAINING U-SHAPED NOTCHES***

➢ ***APPLICATION OF THE STRAIN ENERGY DENSITY CRITERION TO THE ANALYSIS OF FRACTURE LOADS IN GLASS FIBRE REINFORCED POLYAMIDE***

OTHER MEETINGS / COMMUNICATIONS

- II Encuentro Internacional de Doctorandos en Ingeniería Civil – EIDEIC 2016 (Santander, Mayo 2016)

➢ **ANÁLISIS DEL EFECTO ENTALLA EN POLIAMIDA 6 REFORZADA CON FIBRA DE VIDRIO CORTA**

- Seminarios de Investigación del Máster Interuniversitario en Integridad y Durabilidad de Materiales, Componentes y Estructuras (Santander, 04.2016)

➢ **EFECTO DEL CONTENIDO DE FIBRA Y DEL RADIO DE ENTALLA EN PA 6 REFORZADA**

2. Research status/contributions

- 14th International Conference on Fracture (Rhodes-Greece, 06.2017)

➢ ***PROPOSAL OF A STRAIGHTFORWARD STRUCTURAL INTEGRITY ASSESSMENT METHODOLOGY OF COMPONENTS CONTAINING U-SHAPED NOTCHES***

➢ ***APPLICATION OF THE STRAIN ENERGY DENSITY CRITERION TO THE ANALYSIS OF FRACTURE LOADS IN GLASS FIBRE REINFORCED POLYAMIDE***

OTHER MEETINGS / COMMUNICATIONS

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- Seminarios de Investigación del Máster Interuniversitario en Integridad y Durabilidad de Materiales, Componentes y Estructuras (Santander, 04.2016)

➢ **EFECTO DEL CONTENIDO DE FIBRA Y DEL RADIO DE ENTALLA EN PA 6 REFORZADA**

2. Research status/contributions

Organization and management of conferences

❖ 3 days parallel conferences:

- 34th Meeting of the Spanish Society of Structural Integrity – 34º Encuentro del Grupo Español de Fractura (Santander, 03.2017)

➢ **Member of both the scientific and organising committee**

- International Symposium on Notch Fracture (Santander, 03.2017)

➢ **Member of the scientific committee**

➢ **Editor of the publications of the conference:**

o **Proceedings** (ISBN: 978-84-617-9463-8)

o **Book of Abstracts:** (ISBN: 978-84-617-9611-3; D.L: SA-223-2017)

> 150 delegates

2. Research status/contributions

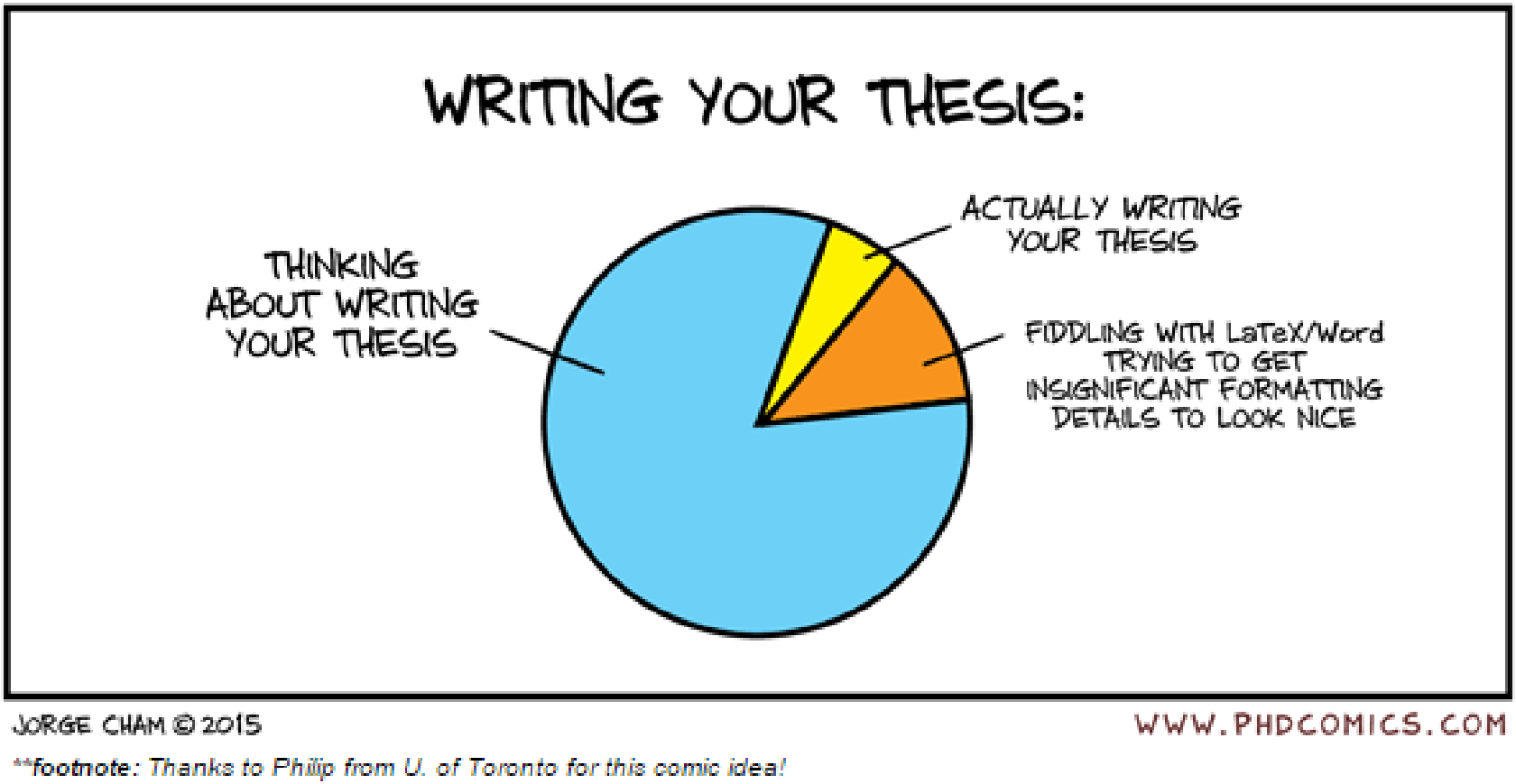
- Collaboration on the coordination of 3 Master Thesis:

➢ **ANÁLISIS DEL EFECTO ENTALLA EN POLIAMIDA 6 REFORZADA CON FIBRA DE VIDRIO CORTA – Isabela Pessoa de Mendoza Procopio *(June 2016)***

➢ **ANÁLISIS DEL MÉTODO SED EN POLIAMIDA 6 REFORZADA CON FIBRA DE VIDRIO CORTA – Cristina Ruiz Palencia *(October 2016)***

➢ **EFECTO DEL CONTENIDO DE HUMEDAD EN EL ANÁLISIS DEL EFECTO ENTALLA EN POLIAMIDA 6 REFORZADA CON FIBRA DE VIDRIO CORTA – Rafael Solar Alonso (On going)**

3. Current work



**footnote: *Thanks to Philip from U. of Toronto for this comic idea!*

Thank you!

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