

# Case studies based on research interests

Nigel Mills & Adam Gilchrist  
Metallurgy and Materials  
University of Birmingham

# Talk outline

- Why use research
- Introducing complex materials
- High-speed video of everyday events
- Quiz questions

# Why use research?

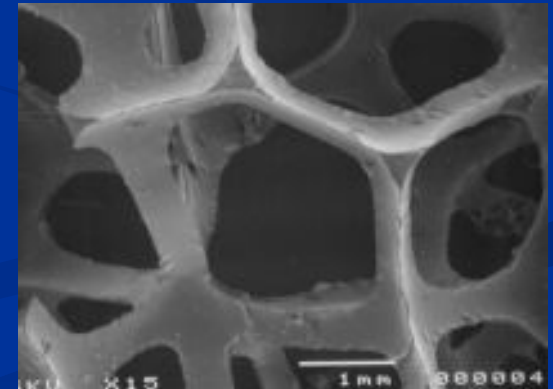
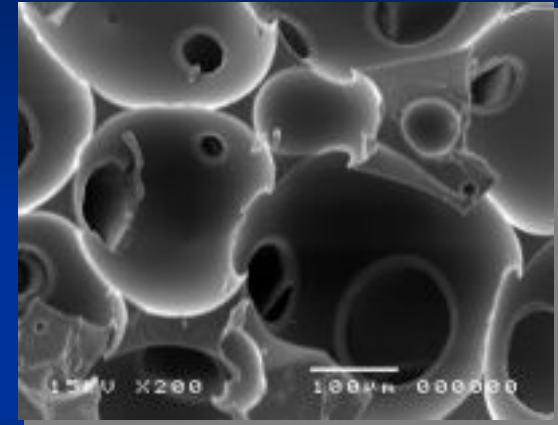
- New topics should be interesting
- Expertise gives you confidence
- Part of research dissemination
- A challenge to simplify

# Website Contents

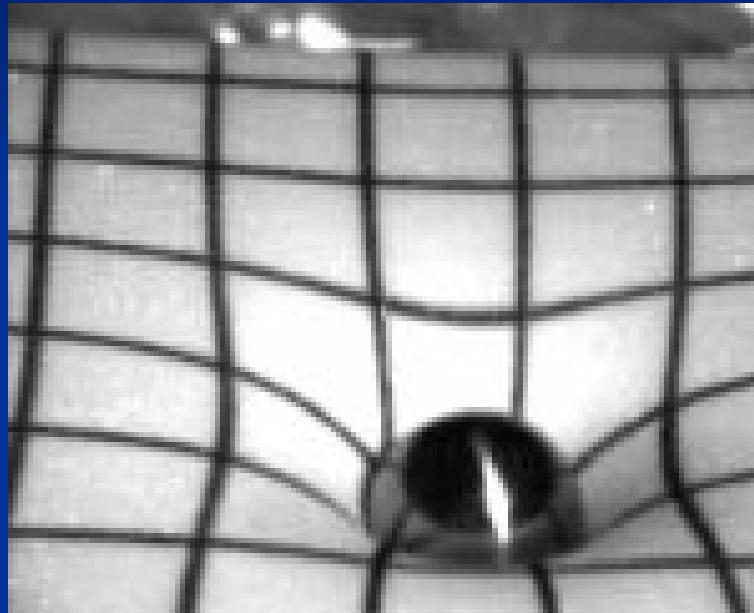
1. Flexible foam in compression
2. Rigid Foam Packaging
3. Seat Cushions and biomechanics

# 1 Flexible open-cell foams

- Foam is a composite – polymer + air
- Students, using a cube compression test, can generate non-linear stress strain graphs
- a sphere bouncing on a foam sheet is **not** a ‘simple’ experiment



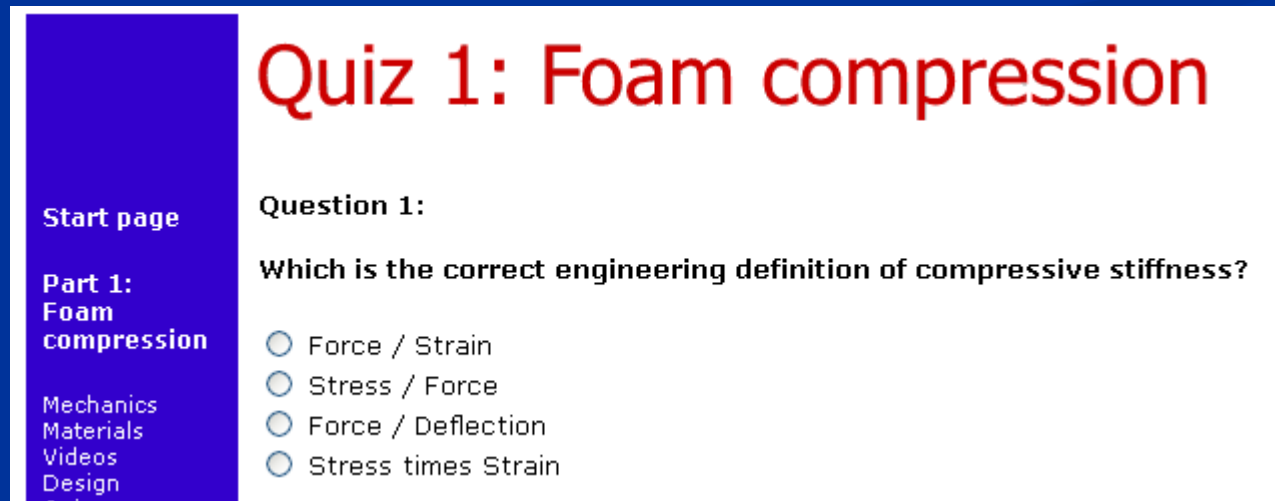
# Video: sphere bounces on foam



- Encourage students to measure rebound resilience

# Quiz on foam compression

- Basic questions to check understanding of mechanics
- Time consuming to have more than 'correct/ try again' feedback



The image shows a screenshot of a quiz interface. On the left, there is a purple sidebar with white text. The top of the sidebar says 'Start page'. Below that, it says 'Part 1: Foam compression'. At the bottom of the sidebar, there are links for 'Mechanics', 'Materials', 'Videos', and 'Design'. The main content area is white and has a red title 'Quiz 1: Foam compression'. Below the title, it says 'Question 1: Which is the correct engineering definition of compressive stiffness?'. There are four radio button options: 'Force / Strain', 'Stress / Force', 'Force / Deflection', and 'Stress times Strain'.

**Start page**

**Part 1:  
Foam  
compression**

Mechanics  
Materials  
Videos  
Design

## Quiz 1: Foam compression

**Question 1:**

**Which is the correct engineering definition of compressive stiffness?**

- Force / Strain
- Stress / Force
- Force / Deflection
- Stress times Strain

## 2: Rigid foam packaging

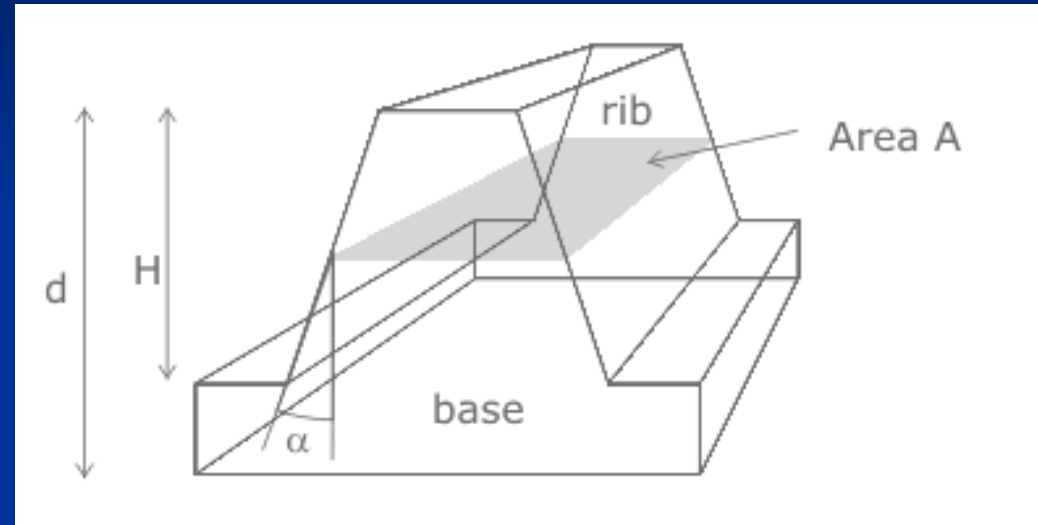
### Materials

Choose between several types of closed-cell packaging (LDPE pouches, bubblewrap, foam)

Relate performance to foam density, packaging geometry, and polymer

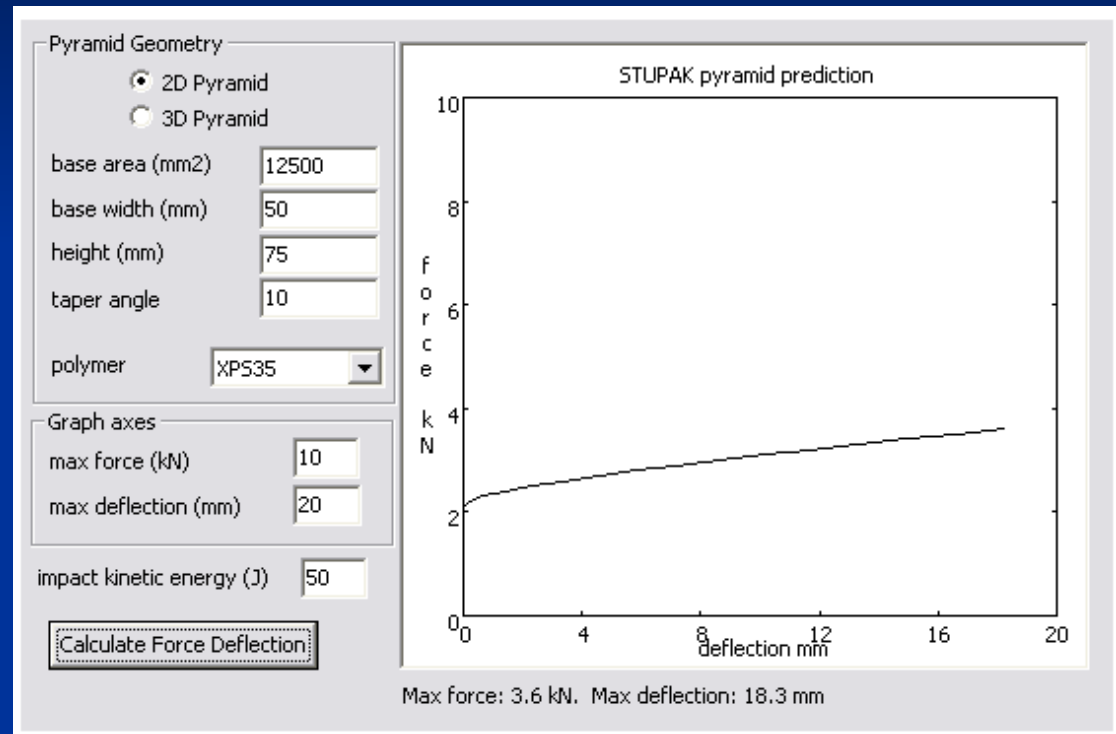
# 2 : Packaging

- Materials
- Foam response
- Geometry
- Videos
- design
- Quiz
- Experiments



# 2: Packaging

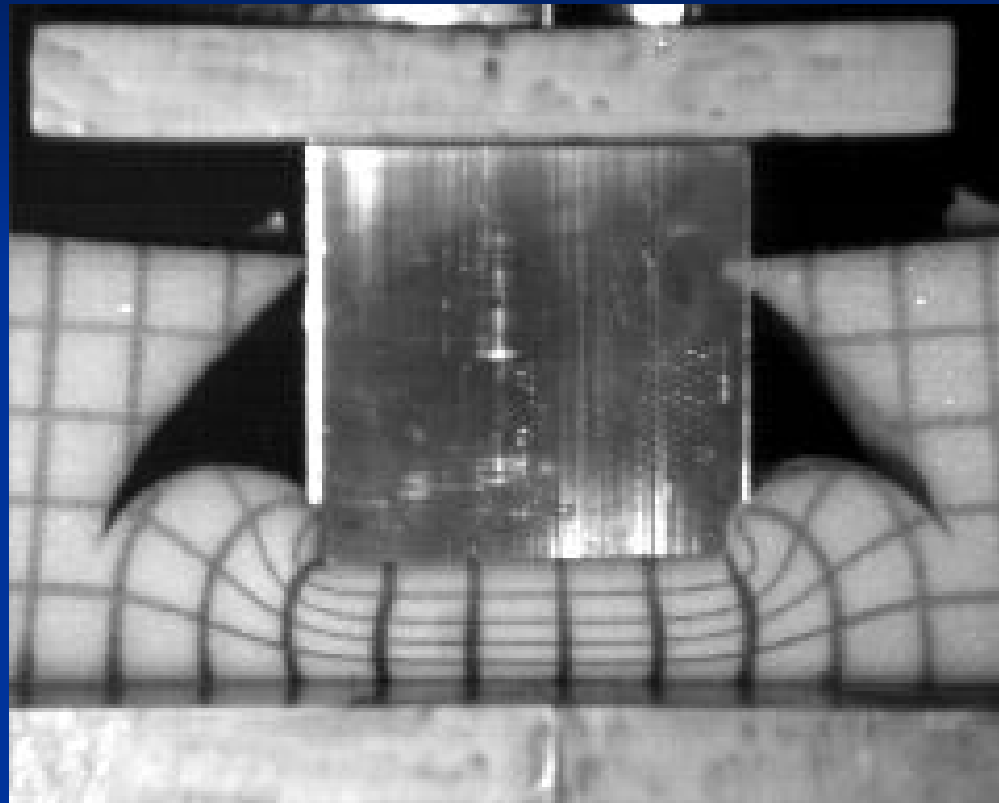
- Materials
- Foam response
- geometry
- Design
- Videos
- Quiz
- Experiments



Real design, using embedded ActiveX control

# 2: Packaging

- Materials
- Foam response
- geometry
- Design
- Videos
- Quiz
- Experiments



Frame of 1000 Hz video, 256 x 256

# 2: Packaging

## Crash Helmets for Eggs

- [Materials](#)
- [Foam response](#)
- [geometry](#)
- [Design](#)
- [Videos](#)
- [Quiz](#)
- [Experiments](#)

Each student pair has an egg + access to packaging

They design and construct a 'helmet' that allows the egg to survive a 10 m drop onto a hard surface.

The lowest mass 'helmet' wins a prize.

# Conclusions

- Research areas are attractive to students
- Worthwhile, since preparing book Polymer foams- engineering, medical and sport applications'
- Website preparation took longer than expected

try it yourself

[www.foamstudies.bham.ac.uk](http://www.foamstudies.bham.ac.uk)

and send us your feedback