

Fig. 5 Deformation modes of (a) empty- (b) foam-filled ($\rho = 0.35 \text{ g/cm}^3$) circular tubes. Reproduced from Hanssen, A.G., Langseth, M., Hopperstad, O.S., 2000. Static and dynamic crushing of circular aluminium extrusions with aluminium foam filler. *Int. J. Impact Eng.* 24 (5), 475–507.

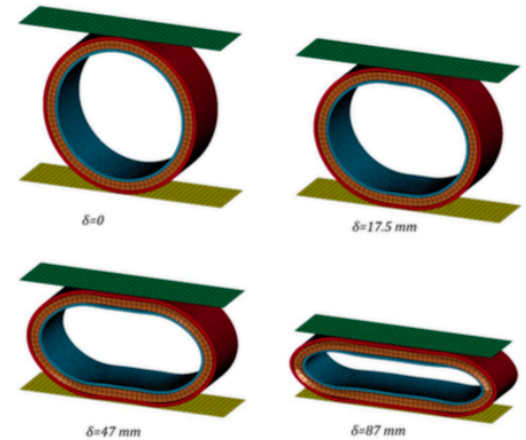


Fig. 10. Collapse sequence of the STFIU under quasi-static loading.

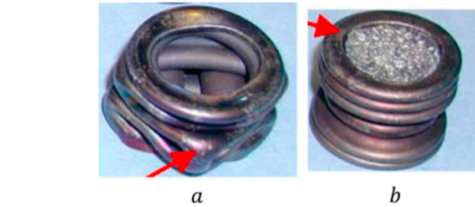


Fig. 6 Diamond and concertina deformation modes of (a) empty- (b) foam-filled long tubes. Reproduced from Asakavithchai, S., Slater, D., Kennedy, A.R., 2004. Effect of tube length on the buckling mode and energy absorption of Al foam-filled tubes. *J. Mater. Sci.* 39 (24), 7395–7396.

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The middle images above are from: A. Baroutaji, A. Arjunan, A. Niknejad, T. Tran, A.-G. Olabi, Application of Cellular Material in Crashworthiness Applications: An Overview, *Ref Modul Mater Sci Mater Eng* (2019)

The right-most images above are from: A. Baroutaji, A.G. Olabi, Lateral collapse of short-length sandwich tubes compressed by different indenters and exposed to external constraints, *Materwiss Werksttech*, 45 (2014)

See:

<https://scholar.google.co.uk/citations?user=JNOFSa4AAAAAJ&hl=en>
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Selected Publications:

Morris, E., Olabi, A. G. and Hashmi, M. S. J. [2006] Analysis of nested tube type energy absorbers with different indenters and exterior constraints,” *Thin-Walled Structures* 44(8), 872–885.

Morris E., Olabi A.G., Hashmi M.S.J.: Lateral crushing of circular and non-circular tube systems under quasi-static conditions. *J. Mater. Process. Technol.* 191, 132–135 (2007)

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Baroutaji A., Morris E., Olabi A.G.: Quasi-static response and multi-objective crashworthiness optimization of oblong tube under lateral loading. *Thin Walled Struct.* **82**, 262–277 (2014)

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H. Nikkhah, A. Baroutaji, A.G. Olabi, Crashworthiness design and optimisation of windowed tubes under axial impact loading, *Thin-Walled Struct*, 142 (2019), pp. 132-148

A. Baroutaji, A. Arjunan, A. Niknejad, T. Tran, A.-G. Olabi, Application of Cellular Material in Crashworthiness Applications: An Overview, *Ref Modul Mater Sci Mater Eng* (2019)

Reza Shams, Abbas Niknejad, Abdul Ghani Olabi and Mohammad Zamani Nejad, “Quasi-static flattening energy absorption process on preformed circular tubes by numerical and experimental analyses”, Article 106260, *Thin-Walled Structures*, Vol. 144, November 2019

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